MAY 1951
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

ERNE C. CARLSON *of Youngstown, Ohio, named president of NECA for the unexpired term of the late Edw. Vanderlinde.*

M. F. ZACK *of Mason City, Iowa, elected NISA president at San Antonio meeting.*

A McGRAW-HILL PUBLICATION | 50TH YEAR

One of three General Electric capacitor equipments recently installed at Los Angeles Fiber Milk Container Plant

By late 1950, American Can had expanded its Fiber Milk Container capacity at Los Angeles to the point that some of the plant's wiring and its main transformers were approaching an overload condition. To remedy this, three G-E capacitor equipments were installed in the basement, each bank containing eight 3-phase, 460-volt Pyranol* capacitors.

This is what happened: Power factor was raised from 68% to better than 90%. Line current was cut by 270 amperes. Because of a kva-demand clause in the power contract, an outright saving of $125 a month in power costs was realized. The capacitors will have paid for themselves in about 26 months!

*Reg. Trademark of General Electric Co.

THESE ARE THE FACTS. Capacitors relieve feeders and transformers of overload, allow for expansion of load and improve voltage conditions. Also, if your power factor is below 85% and if there is a power factor or demand clause in your power contract, chances are you can make similar worthwhile savings.

Read what capacitors have done for others. Write for a copy of GEA-5167, "A Way to Cut Power Cost." Address *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

This New Book Can Help You

"Capacitors for Industry" is a new, complete book on the application of capacitors in industrial installations. Full of up-to-date information, it is the work of four General Electric application and design engineers. "Capacitors for Industry" is the newest member of the General Electric-Wiley book series. Copies may be purchased from John Wiley and Sons, Inc., 440 Fifth Avenue, New York.

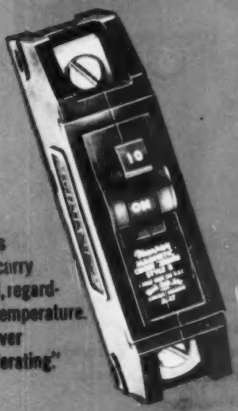
You can put your confidence in—

GENERAL ELECTRIC

407-201

Emerson says:

"Murray Breakers... safe, dependable protection for highly sensitive electronic equipment"



urray reakers ways carry ll load, regard- ss of temperature. ey never ed "derating."

Fully Magnetic!

PHONE CHELSEA 2-1000 CABLE ADDRESS EMPHONOCO NEW YORK CODES BENTLEYS ABC 5TH EDITION IMP

Emerson

RADIO AND PHONOGRAPH CORPORATION

111 EIGHTH AVENUE NEW YORK CITY, 11

Murray Manufacturing Corporation
1250 Atlantic Avenue
Brooklyn 16, New York

Dear Sir:

Every Emerson Television and Radio Set undergoes a series of rigid tests using delicate electronic instruments.

During these tests a momentary short circuit or overload could damage or destroy the electronic equipment. A safe dependable means of circuit protection must be used.

It has been our experience that the Murray fully magnetic circuit breaker provides this safe dependable protection for the highly sensitive electronic equipment used in these tests.

We had tried various other types of circuit protection before we began using the Murray fully magnetic circuit breaker and none operated as well.

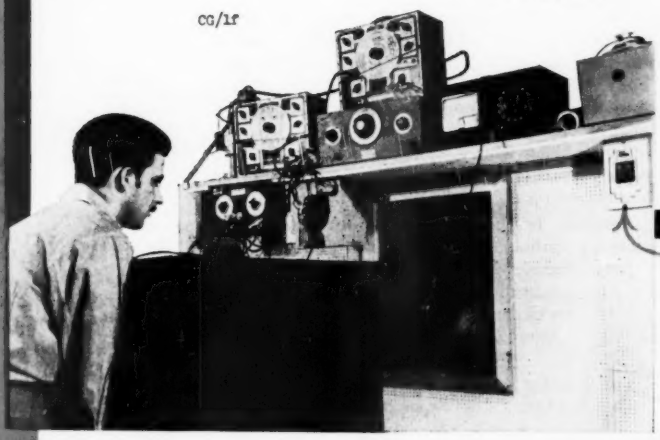
We would not hesitate to recommend very highly the Murray product.

Yours truly,
EMERSON RADIO AND PHONO.

C. Gustafson

C. Gustafson
Plant Engineer

CG/lf



Here is a typical Murray Breaker set-up used by Emerson in testing television sets

For the complete story on Murray Circuit Breakers, write for Bulletin 530

IF YOU WANT TO INSTALL THE BEST... specify Murray®

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue, Brooklyn 16, New York

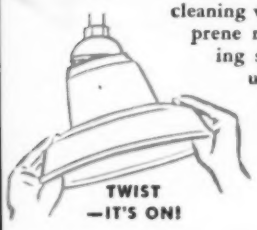
Service Entrance & Meter Equipment • Magnetic Circuit Breakers • Switches • Current Limiting Reactors • Crows'nest Aerial Ladders

NEW APPLETON V-51 SERIES

CONVERTIBLE VAPORTIGHT LIGHTING FIXTURES

WITH MALLEABLE IRON BODIES
100 WATT OR 150-200 WATT UNITS

EXCLUSIVE UNIT ASSEMBLY!



TWIST
—IT'S ON!

Never before a vaportight lighting fixture so safe, so efficient, so easy to install . . . so economically serviced and maintained!

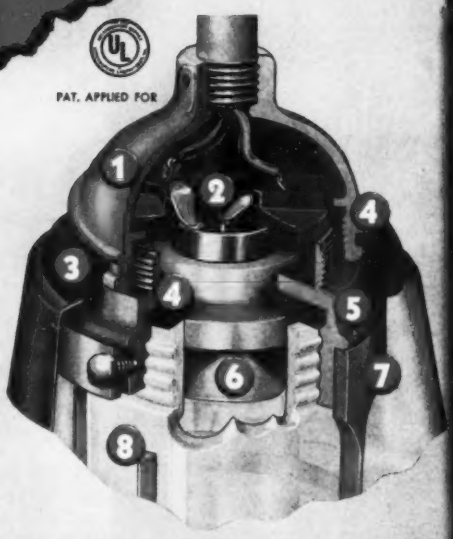
Combined in an exclusive "Unit Assembly," receptacle, globe and guard are detachable as a *single unit* instantly, without tools! Re-lamping or cleaning becomes safe, swift and simple. One trip up the ladder to exchange assemblies, and the job's done!

This outstanding new V-51 line includes 18 different types of rugged malleable iron bodies for pendant, ceiling or bracket mounting. Each body takes both 100 Watt or 150-200 Watt "Unit Assemblies." Each body, except bracket types, is grooved to mount four reflector styles in three different sizes. This *complete interchangeability of parts* permits the assembling of 256 complete fixtures, using only 32 basic components.

Reflector is quickly attached or removed for cleaning without tools—thanks to exclusive neoprene rubber ring attachment. Shock-absorbing socket in "Unit Assembly" permits the use of standard lamps where costlier mill-type lamps were formerly used.

For full details on this great new fixture, write for Bulletin 5-A.

PAT. APPLIED FOR



NEW—INSIDE AND OUT

Sectional View Shows Outstanding New Design and Operating Principles.

1. Malleable iron fixture body.
2. Connecting block with spring leaf contacts.
3. Neoprene rubber ring holds reflector.
4. Vaportight gaskets.
5. Globe and guard adapter body.
6. Shock-absorbing socket.
7. Snap-on type guard.
8. Vaportight globe.

Sold Through Electrical Wholesalers

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1704 Wellington Avenue • Chicago 13, Illinois

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Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

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OUTLET BOXES AND SWITCH BOXES

ELECTRIC

INDUSTRIAL LIGHTING EQUIPMENT

PRODUCTS

EXPLOSION-PROOF FITTINGS • ROLLITE

ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

50th Year—MAY • 1951

ELECTRICAL CONSTRUCTION and MAINTENANCE

MAY, 1951 • Vol. 50, No. 5

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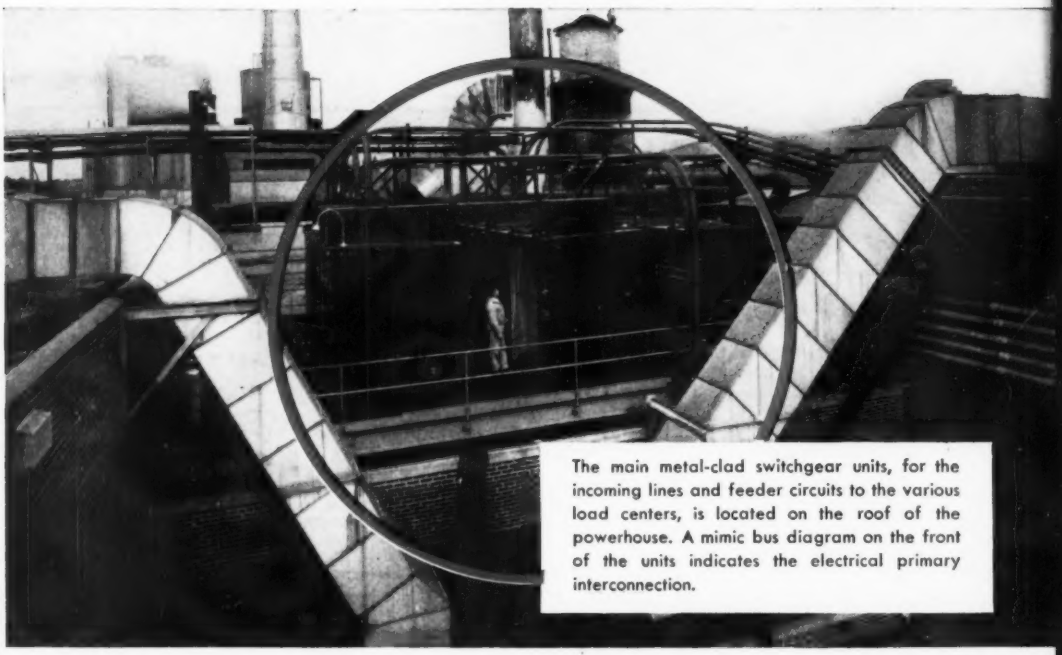


The main metal-clad switchgear units, for the incoming lines and feeder circuits to the various load centers, is located on the roof of the powerhouse. A mimic bus diagram on the front of the units indicates the electrical primary interconnection.

PUTS SWITCHGEAR ON ROOF

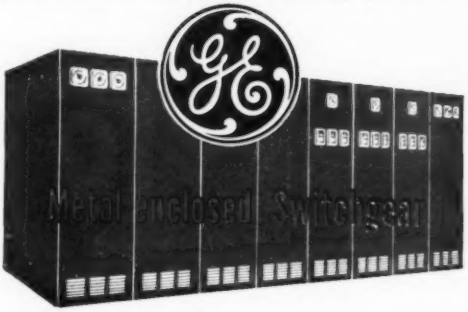
saves 10,000 sq. ft. of floor space

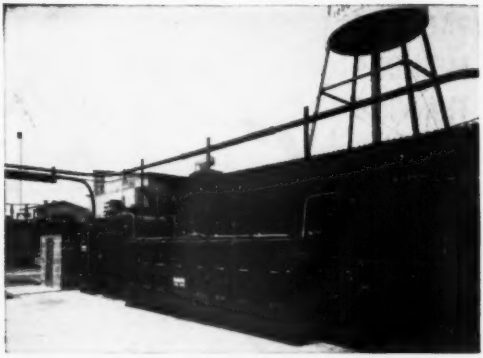
Indoor space limited—installation made with almost no interruption of production —Maintenance will be greatly simplified.

When Scott Paper Company, of Chester, Penna., completely revamped its electrical system to take care of expanded plant output, it made one rather unusual decision. Because indoor space was limited, it put all its switchgear and load-center units on the roofs of the various buildings. The incoming utility power lines, at 13,200 volts, terminate in General Electric outdoor metal-clad switchgear on the roof of the powerhouse, and the 575-volt distribution system is fed through G-E metal-enclosed gear located on roofs of the individual buildings. Distribution between buildings is at 13,200 volts with step-down load-center units.

This type of installation has proved to have a number of advantages. In the case of Scott Paper, 10,000 square feet of badly needed floor space became available for paper making. The entire installation could be made during normal working hours, yet did not interfere with plant production. Likewise, routine inspection and maintenance can be done without entering the manufacturing areas. All breakers are of the easily-removable type that is so easy to maintain and inspect.

What's more, there's plenty of space for expansion. Provision has been made to double the capacity—by adding transformers and switchgear—when still more electric power is needed later. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

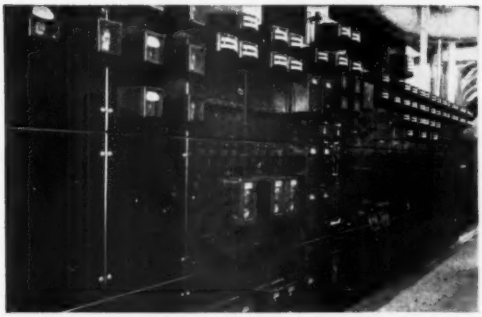


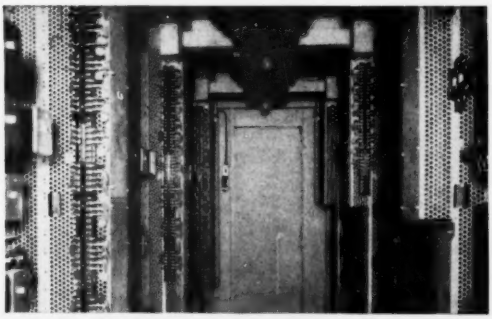


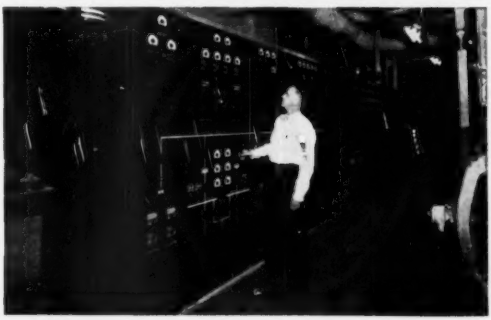
A double ended load-center unit feeding the large 2300-volt motors in one of the main buildings. Unit consists of two power transformers with air-interrupter disconnects, and metal-clad switchgear units for metering and for the four magne-blast air circuit breakers.

One of several single-ended load centers, which can be doubled in capacity later by adding a second transformer and low-voltage switchgear units. This particular unit uses metal-enclosed gear with draw-out air breakers to 575-volt feeders which serve the paper finishing units.

New switchboards simplify control — Increase safety







BEFORE Front and rear views of the old switchboard which handled all the plant's power at 575 volts. Open buses, breakers, knife-switches, and resistors were a definite hazard — and one bad short circuit or fire could have closed down the plant.

AFTER Main switchboard is now simply a control board. Incoming line and feeder circuits can all be closed from this one location. No power lines or high voltage is brought to this board at all — and there are no open buses or switches to form a hazard to personnel.

854-33

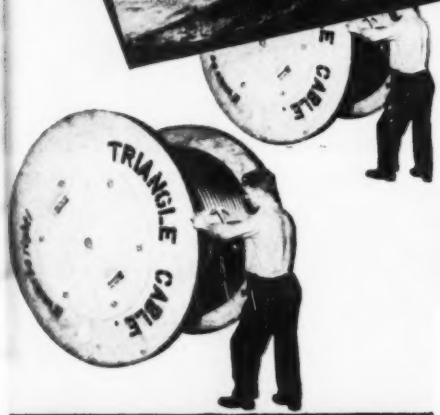
GENERAL ELECTRIC

EXPERIENCE + MODERN FACILITIES / MODERN METHODS / MODERN THINKING

MEANS

"It MUST Be Right!"

Triangle's two plants—one making wire and cable in New Brunswick, New Jersey, the other making conduit in Moundsville, West Virginia, have kept pace through the years with every advancement and are completely modern in machinery and equipment.



When it comes to wire, cable or conduit, you want assurance that it's *right* — right in quality, right in performance. Triangle products *are* right! Triangle's *long experience* coupled with modern machinery, modern methods and modern thinking means "It *Must* Be Right!"

Triangle products are built to the highest possible specifications under the supervision of craftsmen who take pride in surpassing accepted standards.

Experience plus modern facilities, modern methods, modern thinking — that's why Triangle can say with confidence — "IT *MUST* BE RIGHT!" That's why you can specify Triangle and know that "IT *IS* RIGHT!"

THIS MAN WANTS TO HELP YOU!

He is your Triangle Distributor. In the same way Triangle offers quality *products*, your Triangle Distributor offers unexcelled *service*. See your Triangle Distributor *first*. In the long run you'll save and get it faster, from a Triangle Distributor.

THE TRADE-MARK OF TOP QUALITY!

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

IT *MUST* BE RIGHT

"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Armored Cable • Service Entrance, Service Drop, Varnished Cambric Braided or Leaded, Trioprene Trench, Power and Parkway Cables • Bare Wire • Rigid Conduit Hot-Dipped Galvanized • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit

AMONG THOROUGHBREDS ONE IS OUTSTANDING

At Belmont in 1920, three-year old Man O'War led the field in the Lawrence Realization Stake. He covered the 1½ miles in 2:40⅕. Previously he had won 16 of 17 starts, establishing three U. S. records. He was rated the fastest horse in America.

AND AMONG CERTIFIED BALLASTS—ONE IS OUTSTANDING

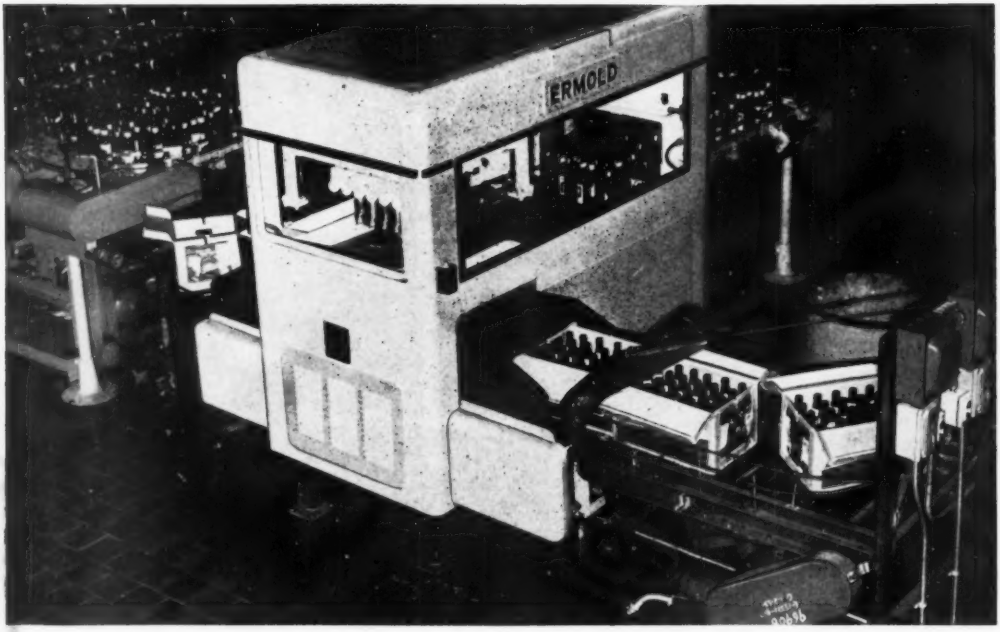
"Certified" means a ballast built to meet electrical specifications established to assure good performance of your fluorescent lighting. Thus, "Certified" represents the standard for a good ballast. But, to ***meet*** a standard is one thing—to consistently ***exceed*** it is another. And, it's that 'extra quality for your dollar'—built into every G-E. ballast*—that assures you of not just good, but absolute top performance for your lighting.

To let your customers know you use only the best, display the famous G-E tag on your fixtures. For information on G-E ballasts and G-E tags contact the ballast specialist at your nearest G-E office.

*Since Certified ballasts represent only a portion of the total ratings available, it's important to you to know that General Electric builds the same 'extra quality' into all its ballasts, whether Certified or not. ***General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

412-92



New Automatic Unpacker powered by G-E Dry-type Transformers

"Unpacking and distributing cases of bottles as they return to bottlers is a heavy duty operation requiring dependable voltage supply," says the Edward Ermold Company, New York. We have used a G-E dry-type transformer in our automatic unpacker for its voltage supply. For dependable operation day after day, we've found G-E transformers really do the job."

WHEN YOU NEED DEPENDABILITY SPECIFY

G-E DRY-TYPE TRANSFORMERS

G-E dry-type transformers *look* as if they could do a job, *and they can.* They're designed to dissipate heat rapidly—built for years of reliable service. Top-quality varnishes, specification steels, and thorough inspection give you downright dependability on the job.

Plan now to cut maintenance and operation costs. Specify General Electric dry-type transformers. For more information see your local electrical distributor, or contact your nearest G-E Sales Office. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

You can put your confidence in—

GENERAL ELECTRIC

411-86

YOUR COMPLETE NEW CATALOG OF

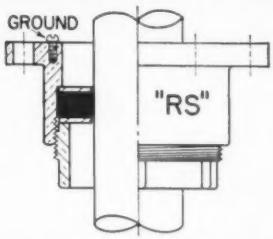
G&W POTHEADS

Complete listings make this bulletin a must for your desk. Keep it handy for easy reference to all ratings and shapes of G&W Potheads and related information.

LISTING FOR THE FIRST TIME

NEW *UNIVERSAL* ENTRANCE

FOR ALL TYPES OF CABLE



TYPE "RS" RESISTOYL ENTRANCE SEAL

Stuffing box with "Resistoyl" gaskets makes water, oil, and compound-tight seal on any cable sheath. Easily installed fittings furnished for conduit, armor, and wire armor.

- **Capnut Terminal Potheads**
- **Disconnecting Potheads**
- **Straight Through Potheads**
- **Equipment Type Potheads**
- **New Shape "CL" 45° Angle Bodies**
- **New Shape "A" Pole-Top Potheads**
- **Special Listings of All Parts**
- **Spreader Heads**
- **Insulating Compound**
- **Installation Instructions**
- **New Universal Cable Entrance**

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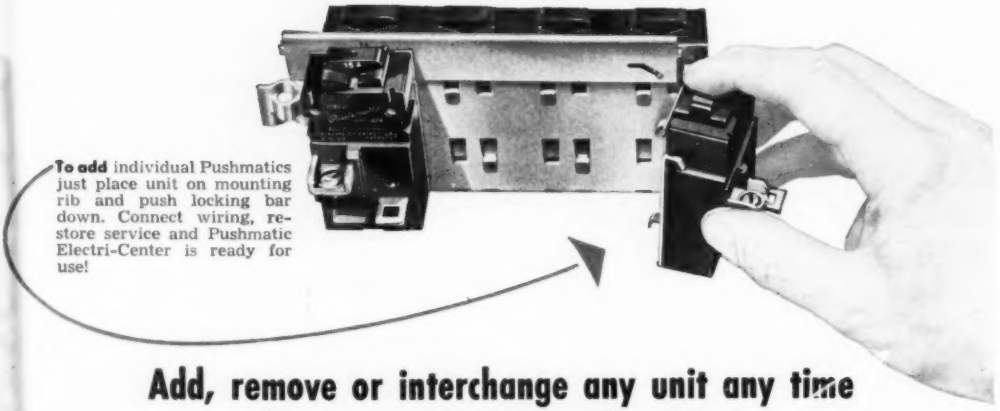
☐ *Check here if you would also like a copy of Bulletin AA50, Type "ST-SODERTITE" potheads with metal parts soldered directly to porcelain.*

Meet specific panelboard needs faster with interchangeable *Pushmatics*®



To add individual Pushmatics just place unit on mounting rib and push locking bar down. Connect wiring, restore service and Pushmatic Electri-Center is ready for use!

Add, remove or interchange any unit any time for any combination of ratings!

NEVER before has a panelboard offered the flexibility of BullDog Pushmatic Electri-Centers!

Pushmatics are the same size, regardless of rating or type, and are completely interchangeable. Any Pushmatic can be installed at any point on the mounting rib. Pushmatics can be added to the Electri-Center faster, more economically and with less confusion.

Exclusive push-button switching, too!

PUSH . . . it's on! PUSH . . . it's off! PUSH . . . it's on again if circuit is broken by short or overload. Pushmatic offers the simplest switching available anywhere. No complicated resetting to fuss with . . . no fuses to replace.

And you can meet any load condition with these Pushmatics: Standard Thermal MAGNETIC and Thermal ULTRA-MAGNETIC, the latter available with or without BullDog's exclusive AMBIENT COMPENSATING FEATURES. Ratings of 15, 20, 30, 40 and 50 amperes, 1 pole, 120 V., or 2 poles, 120-240 V., A.C.

Now investigate Pushmatic Electri-Centers . . . the finest panelboards on the market.

Handsome BullDog Pushmatic Electri-Centers are available from 2 to 42 circuits. Pictured: 8-circuit Service Equipment Type. Plenty of wiring room even in smallest Electri-Centers for easier installation.

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DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES
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due to improved
more economical production methods
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with

GUTH SEELUX

- 3 ring, open-bottom, for silver bowl lamps
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- lifetime beauty, efficiency
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- an outstanding example of functional simplicity and beauty

HEATPROOF ALZAK FINISH**
is not discolored or affected by lamp heat.

DUSTLESS OPEN BOTTOM
minimizes cleaning—dirt falls through.

SILVERBOWL LAMP
provides built-in reflector. Peak efficiency is automatically restored; when lamp is replaced, you have a new reflector.

Send for our Bulletin 864-A with full details on the SEELUX, SEELUX Plus and other fine GUTH Incandescent Indirects.

*Ⓟ and Patents Pending

**Ⓡ and Patented, Aluminum Co. of America

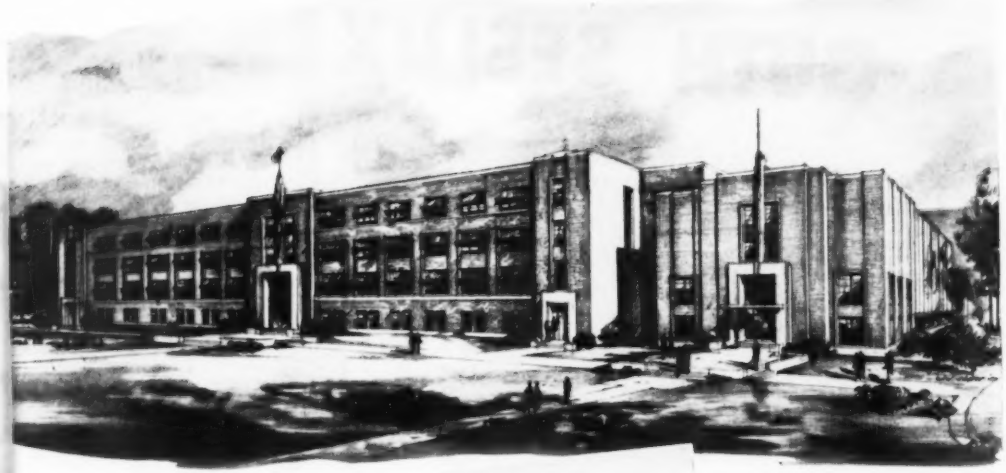
Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting Since 1902

NEW MILLION-DOLLAR HIGH SCHOOL

Wired *the Modern Way*



Divine Savior High School, Wauwatosa, Wisconsin. Architects: E. Bridgmeier & Sons Co., Milwaukee. General Contractors: Hunzinger Construction Company, Milwaukee. Electrical Contractors: Magaw Electric Company, Milwaukee.

Cutting, bending, and fitting-up go fast with ELECTRUNITE E. M. T. *Raceways. Only simple tools are required to produce tight, easy-to-fish installations.*

with ELECTRUNITE E.M.T. Raceways

● Almost 8 miles of Republic ELECTRUNITE E.M.T. protect the wiring circuits in this modern, 1¼-million-dollar high school building. Conductors are completely protected from dampness, fire, and mechanical damage. Fire-proofness of all types of buildings is increased. Surveys show wiring costs are reduced and building completion is speeded . . . sound reasons for specifying "ELECTRUNITE E.M.T. Raceways."

ELECTRUNITE E.M.T. is the light-but-strong, threadless, rigid steel raceway that's changing the wiring habits of the nation. It's inspected by Underwriters' Laboratories, meets the National Electrical Code and most local codes for exposed, concealed, and concrete-slab installations. Inch-marking, plus uniform structure and walls, make ELECTRUNITE E.M.T. easy to cut, bend, and install, easy to fit-up with connectors and couplings. Knurled inside surface assures easy, trouble-free fishing and wire pulling.

CHECK WITH YOUR ELECTRUNITE DISTRIBUTOR

His stocks of popular ELECTRUNITE E.M.T. Raceways may not always include the sizes and quantities you need. Let him know your requirements as far ahead as possible . . . he'll make every effort to supply you.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

REPUBLIC STEEL

Republic ELECTRUNITE E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

NEW

HOOK-ON INSTRUMENT

reads power factor directly
...without interrupting service

TYPE AK-3 HOOK-ON POWER-FACTOR METER

Now, for the first time, you can read power factor without breaking circuits . . . and without mathematics. You just clip on the voltage leads, hook around the line, and rotate the simple selector dial for direct reading.

With the handy new AK-3, you quickly locate circuits where power factor needs improvement . . . find out where to spot correcting capacitors. You can use the AK-3 on any balanced 3-phase circuit with 100-600 volts, 15-600 amperes. Accuracy is within 0.05 PF.

ASK YOUR G-E REPRESENTATIVE to demonstrate the new AK-3 Power-factor Meter today. Or write for bulletin GEC-789, General Electric Company, Schenectady 5, N. Y.

price **$84.75***
leather case **$10.00***
*MANUFACTURER'S SUGGESTED RETAIL PRICE

GENERAL ELECTRIC

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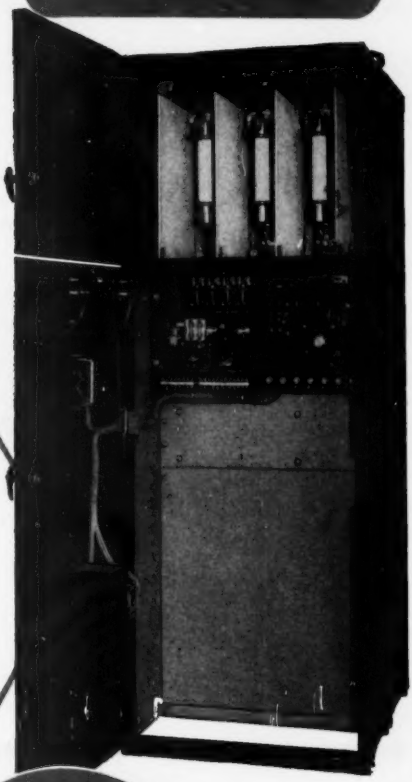
Complete Control and Protection for Your Motors

ALLIS-CHALMERS

Type H Starters

FOR 2300 TO 6600 VOLT MOTORS



ONE ATTRACTIVE easy-to-install steel cabinet is all you need between line and motor when you specify Allis-Chalmers Type H Starters. Contactors, protective devices, meters, relays . . . everything you need for complete control and protection of your motors is built into Type H Starters. You get:

1 **Short Circuit Protection . . . provided by current limiting fuses that are easily accessible.**

2 **Overload Protection . . . Thermal relays have compensating elements — automatically adjust for ambient temperatures — trip on motor overload only.**

3 **Safe, Accessible Cubicle . . . upper front compartment encloses disconnect type fuses; lower front compartment, the low voltage control devices; rear compartment, the high voltage equipment.**

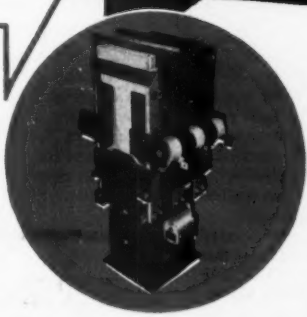
4 **Easy Installation . . . single steel enclosure is easy to handle, internal wiring is complete, wiring terminals accessible, easy to connect.**

5 **Personnel Protection . . . high voltage fuse compartment has electrical interlock.**

6 **Meters, Push Buttons, Recording Instruments, Rheostats, and similar devices you may need are mounted on the door of the low voltage compartment.**

Other features include undervoltage protection . . . and your choice of either air break or oil immersed contactors — whichever is best for your application.

For motor control that is engineered to your job, specify Allis-Chalmers Type H Starters for motors with ratings up to 2500 hp. Call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 14B6410A.



Specify Type 256 Air Break Contactor, shown, for tough, repetitive duty, longer contact life . . . Type MO Oil Immersed Contactor for normal starting duty or for service in dust laden, corrosive or very moist atmospheres.

A-3350

ALLIS-CHALMERS

Lighting by Litecontrol makes this
a Store with $ales Vision

TRENCH VARIETY STORE, MINNEAPOLIS, MINN.

Lighting Consultant: James McCracken, Northern States Power Co. Contractor: Heights Electric Co., Minneapolis. Fixtures: Litecontrol No. 5828, 8 ft. Slimline Louvered Troffers. Spacing: 8 ft. on centers. Watts per sq. ft., 2.08. Average intensity in service: 35 footcandles.

This Trench Variety Store in Minneapolis emphasizes modern merchandising from street entrance to storeroom. Clean lines and functional space-saving keynote the layout—

. . . and, of course . . . *an excellent lighting job "wraps up the package."*

Sales-minded planning here dictated the use of Litecontrol Fixtures...in this case, the increasingly popular No. 5828 Slimline Recessed Louvered Units. Made for two or three lamps, this unit offers the convenience of hinged egg-crate louvers. Louvers are enclosed in metal frame for safety and are opened from either side by means of spring-loaded catches. Easy to service and easy on the eyes, Litecontrol Fixtures are justly famed for putting *every* product in the best possible light.

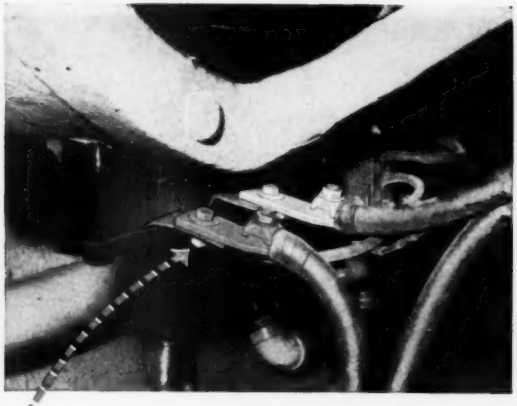
For lighting installations of this or any type, you'll save time and trouble by letting your Litecontrol Representative help you with your problem. Try him next time . . . and *see!*

LITECONTROL *Fixtures*

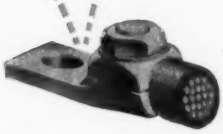
KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



to get



re-use...

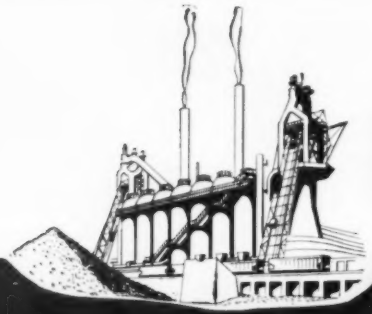
use QIKLUG

To cut costs, conserve materials, and make your supplies go further, it's wise today to use Burndy Qiklug connectors. Built for durability, Burndy Qiklugs are constructed of high-conductivity, corrosion-resistant alloys, with clean, husky threads... so they can be used over and over again! Added to Qiklug's ease of installation (with an ordinary wrench) and compact design, this timely, extra-life advantage makes it more important than ever to use... and *re-use*... Qiklug!

BURNDY CONNECTORS

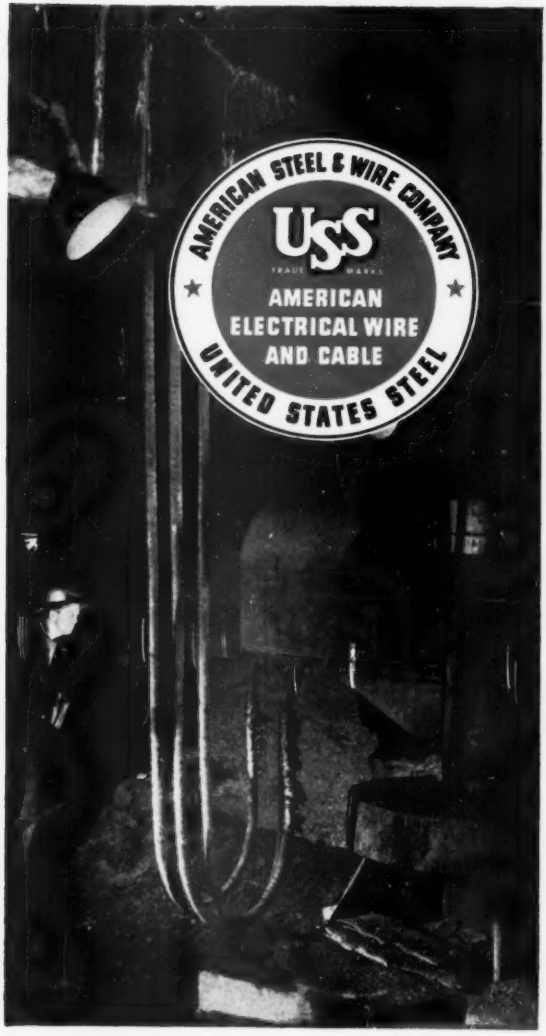
BURNDY, New York 54 • Western Branch: Vernon 58, Cal. • Burndy Canada Ltd., Toronto 8, Ontario

251



Hot-spot life line

for a gun that shoots mud



THAT electric gun squirts mud into the bottom of the blast furnace to plug it up after the furnace is tapped. It operates day-in and day-out—right over the molten iron that comes boiling out at 2500°F.

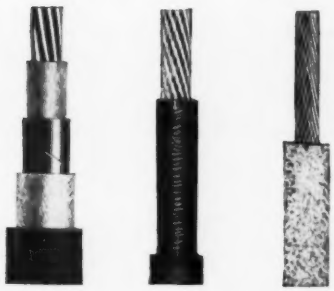
The mud gun rotates 180° during its work cycle, so the cable is continually flexed.

And, since part of the cable is right next to the blast furnace cooling water, it is exposed to hot steam. The cable must withstand graphite, grit and an incredible amount of dirt. It would be difficult—or impossible—to find tougher operating conditions than encountered in this blast furnace mud gun operation.

When asked about the Amerbestos AVC Cables used on this gun, the Electrical Engineer at the plant said that it had given *many times* the service of any other cable they had ever used. "And," he added, "it has given the least amount of trouble in service."

So if *you* have a hot-spot wiring problem, get all the facts on Amerbestos. Our nearest District Engineer will help you pick the best wire or cable for your job.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



USS

American Electrical Wire and Cable

UNITED STATES STEEL

Safety-Circle Motors Give You Extra Protection 3 Vital Ways

1 Protection Against Electrical Breakdown — Stator punchings of low-loss electrical steel are welded together to form a rigid base for the windings. Complete stator is multiple dipped in special insulating varnish and baked after each dip. Special cambric insulation is placed in coil ends between phases to provide further protection against electrical breakdown.

2 Protection Against Physical Damage — Cast iron frame completely enclosing working parts on all sides rigidly maintains alignment and protects motor against blows, falling objects and other physical damage. Cast iron inherently resists corrosion better than other metals used for similar purposes.

3 Protection Against High Maintenance Costs — Bearings are pre-lubricated at the factory and should need no attention for long periods. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are provided.

NOW, when costs are high and skilled labor is becoming scarce, you need these extra protection features that only *Safety-Circle* Motors give. 94 Allis-Chalmers Certified Service shops throughout the country give you economical, factory approved service and genuine parts.

Call your Allis-Chalmers Authorized Dealer or Sales Office for your motor needs, or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin **51B6210.**

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-3340

today

. . . with *long life* the watch word for Service Entrance Cable . . . you need the permanence of insulations made with FIBERGLAS* Yarns.

Used in OUTER BRAID, MOISTURE-SEAL TAPE and CONDUCTOR COVERING, Fiberglas Yarns help provide—

- high tensile strength with minimum bulk . . . smaller cable that's easier to handle, easier to install!
- resistance to rot, moisture, heat and age . . . cable that lasts *far longer!*

Because of increasing military requirements for Fiberglas Yarns, our customers are unable to get all they need. We are building new facilities to help meet these demands.

OWENS-CORNING FIBERGLAS *Yarns*

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibrous glass.

FIBERGLAS IS IN YOUR LIFE...FOR GOOD!

Owens-Corning Fiberglas Corporation
Electrical Sales Division
16 E. 56th Street, New York 22, N. Y.

Please send your new booklet describing wires and cables insulated with Fiberglas Yarns.

Name.....

Title.....

Company.....

Street.....

City.....*Zone*....*State*.....856

CERTIFIED BALLASTS are *Quiet*

Audible "humming" from a fluorescent ballast is highly annoying . . . yet some people believe this noise is an unavoidable part of fluorescent lighting.

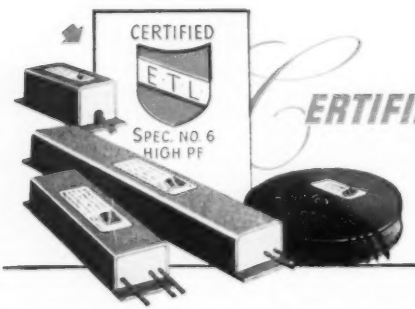
This is not true. Seldom do you hear a **CERTIFIED BALLAST** that is properly installed in a fixture. It operates efficiently and quietly.

Freedom from noise is but one advantage of **CERTIFIED BALLASTS.** You also get...

- Maximum light output (poor ballasts may reduce light by 20%)
- Full lamp life (poor ballasts may shorten lamp life by ⅓)
- Long, trouble-free, dependable service.

CERTIFIED BALLASTS are made to exacting specifications, then tested and checked by Electrical Testing Laboratories, Inc.

• Complete information on the types of CERTIFIED BALLASTS available from each participating manufacturer may be obtained from Electrical Testing Laboratories, Inc., East End Avenue at 79th Street, New York, New York.



Participation in the CERTIFIED BALLAST program is open to any manufacturer who complies with the requirements of CERTIFIED BALLAST MANUFACTURERS.

CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

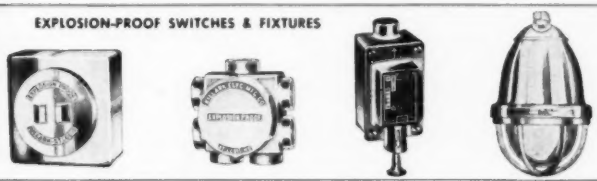
Killark

KILLARK ST. LOUIS

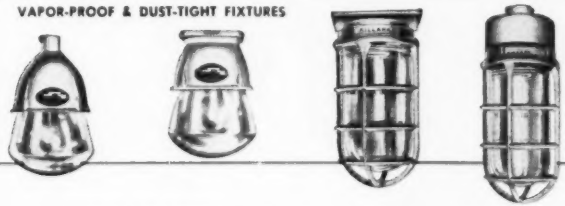
FITTING AMERICAN INDUSTRY FOR DEFENSE

CONDUIT FITTINGS

EXPLOSION-PROOF SWITCHES & FIXTURES



VAPOR-PROOF & DUST-TIGHT FIXTURES



DEFENSE JOBS USING KILLARK FITTINGS

ABERDEEN PROVING GROUNDS
ANDREWS AIR FORCE BASE
ANNISTON ORDNANCE DEPOT
ATERBURY AIR FIELD
ATOMIC ENERGY COMMISSION
BERNSTRON AIR FIELD
BIKINI ATOLL ATOMIC
BLUE GRASS ORDNANCE
BROOKLYN AIR FORCE BASE
CASCADE RADAR STATION
DANA PROJECT
DOUGLAS AIRCRAFT
ELGIN AIR FORCE BASE
FORT CAMPBELL
HERCULES POWDER PLANT
HOLSTON DEFENSE CORP.
KELLEY AIR FORCE BASE
KINGSBURY ORDNANCE PLANT
KIRKLAND AIR FORCE BASE
LAKE CITY ARSENAL
LOS ALAMOS ATOMIC PROJECT
MILAN ARSENAL
MONSANTO CHEMICAL CO.
OAK RIDGE ATOMIC PROJECT
OGDEN ARSENAL
RANDOLPH AIR FORCE BASE
REDSTONE ARSENAL
ROCKY MOUNTAIN ARSENAL
SAVANNAH ORDNANCE DEPOT
SCOTT AIR FORCE BASE
SUNFLOWER ORDNANCE WORKS
TINKER ARMY AIR FIELD
TYNDALL AIR FORCE BASE
VANCE AIR FORCE
WESTERN CARTRIDGE

"QUICK DELIVERY!" Important words these days—when a prompt supply source can be a national essential. Killark's control of metal and ultra-modern production methods are keyed to respond to your most urgent defense construction needs.

STRATEGIC LOCATION. Central geographic position of our foundry and factory, PLUS 12 *warehouses through the country*, are your multiple assurance of quickly-filled orders and speedy shipments.

KILLARK products offer individual advantages, too. They can't RUST. Made of ALUMALLOY for greater malleability, and die-cast under 10,000 lbs. pressure, they are 60% lighter than iron . . . are weatherproof clear through . . . non-corrosible . . . smooth satin-like finish . . . precise clean-cut threads . . . safe, non-sparking, desirable for hazardous locations.

Killark

KILLARK ST. LOUIS

The *KILLARK* CATALOG lists the COMPLETE LINE. Write for your copy.

ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves. — **St. Louis 13, Missouri**

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NEW YORK	30 Irving Place		
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TYPE AVRB
15 to 100 kva

TYPE AJRB
3 to 10 kva

TRIPLE

Protection against Overloads

Trouble caused by short circuits or by transformer overloads is stopped before it starts when you use Westinghouse Dry-Type Transformers with built-in circuit breakers. The breakers are connected in the high-voltage circuit, and are actuated by either (1) the coil-load current, (2) the temperature of the air within the transformer or (3) by both. This triple action provides *complete protection . . . sure* safety for circuits if trouble occurs. Furthermore, the co-ordinated time lag of the breaker permits carrying nondamaging, short-time overloads without service interruption.

You can get quick, economical correction of overloaded circuits with Westinghouse Dry-Type Transformers that have breaker performance like this . . . plus these additional features:

LOW INSTALLATION COST: Connect direct to wiring or raceways. Because you can install dry-type transformers close to the load, long runs of low-voltage lines can be eliminated.

EASY MOUNTING: Mount them wherever power is needed—on the floor, walls, columns, platforms, or overhead.

LOW MAINTENANCE COST: Dry-type construction is recognized as the "minimum maintenance" transformer design.

Save on power costs—run *your* distribution voltage close to the load with Westinghouse Dry-Type Transformers. Available in hv ratings of 600, 480 and 240. 100 kva and below, single phase. Ask your Westinghouse representative for Booklet B-4439, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70555

Westinghouse

DRY-TYPE TRANSFORMERS

why there can be

NO OTHER ANSWER IN SAFETY SWITCH SELECTION

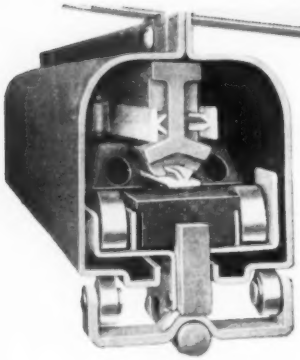
Engineering research authenticated by outstanding authorities has conclusively established "internal heating" to be the principal cause of safety switch failures. This "internal heating" literally bakes the life right out of safety switch parts, causing insulating materials to disintegrate and metal parts to distort and corrode. The safety switch then either becomes inoperative or it "burns up" through inability to carry the load.

In properly constructed safety switches, fuses are almost entirely responsible for this destructive "internal heating." This is not a criticism of fuses for *any* fuse operating up to its rated load *must* be near its melting point if it is to perform properly when an overload occurs. And any metal operating *near* its melting point *must* be hot . . . and fuse links are *hot* . . . with temperatures running as high as 700 degrees Fahrenheit.

Since you cannot vent trapped heated air through a safety switch enclosure and still keep a safety switch *safe*, the only escape from the ravages of "internal heating" *must* come through the selection of materials for the internal safety switch structure and the design of that structure to *withstand successfully the unavoidable heat conditions met in safety switch service.*

Cutler-Hammer Safety Switches were completely redesigned in this way *ten years ago* to beat "internal heating" when engineering research clearly indicated the need for *such* safety switches. Nine years of experience shows the Cutler-Hammer claim of better safety switch performance far more than a mere promise; it is a proven *fact* that demonstrates why there can be no other answer in safety switch selection. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.

Visit our booth, National Association of Electrical Distributors, May 21-25, Atlantic City Booth No. 107A

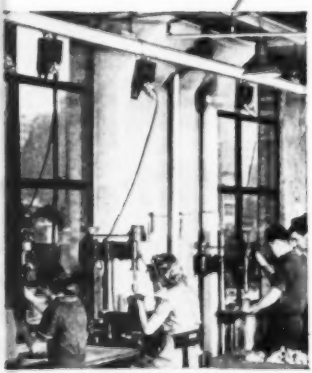


ARE YOU WIRING for HIGH PRODUCTION?

The heat is on for all-out production. Work stoppages due to electrical failures can no longer be tolerated, and maintenance crews will be busy enough without chasing down broken wiring, defective plugs and other electrical "accidents."

The plant wired with ELECTRIC FEEDRAIL, the modern overhead trolley-busway system, is ready for any production changes. No wires on the floor, or in the operators' way. Everything is connected overhead thru trolleys that move along the line, or can be removed to another line. Each tool or machine can be protected by fuses or circuit breakers on the trolley, and tools can be suspended by balancers when desired.

FEEDRAIL is ideal for cranes and hoists, moving test lines, lighting, cutting and sewing machines. Write for Bulletins describing applications and technical features.



PRODUCTION LINE

ELECTRICAL CONTRACTORS

everywhere are recommending FEEDRAIL systems, for once installed, the increases in production suggest additional uses. Investigate the progressive FEEDRAIL system and plan for profit.

41-C

CONVEYOR ASSEMBLY LINE

CUTTING MACHINES

ELECTRIC FEEDRAIL "NEVER BECOMES OBSOLETE"

FEEDRAIL CORPORATION

Subsidiary of Russell & Stell Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

4 important suggestions on G-E remote-control wiring

Switch-controlled Triple Outlet

To help you add extra convenience to remote-control installations, General Electric announces a new switch-controlled triple outlet RO-2 which lets you make any combination of switch-operated and permanently live outlets. Outlet and plate in one piece for easy installation.

New Contractor's Manual

General Electric now has available a complete manual on the remote-control wiring system. In 36 pages, it gives you all the facts on layout, wiring time savers, and important installation facts. Let this booklet bring you up to date on G-E remote control. Write for a free copy of G-E Remote Control Wiring System Manual to Section D56-318, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

Conservation of Materials

General Electric remote-control wiring may be your answer if material shortages begin to give you trouble. Because it uses small size low-voltage wire, G-E remote-control wiring can save as much as 34% of steel and 20% of copper in a typical 6-room house.

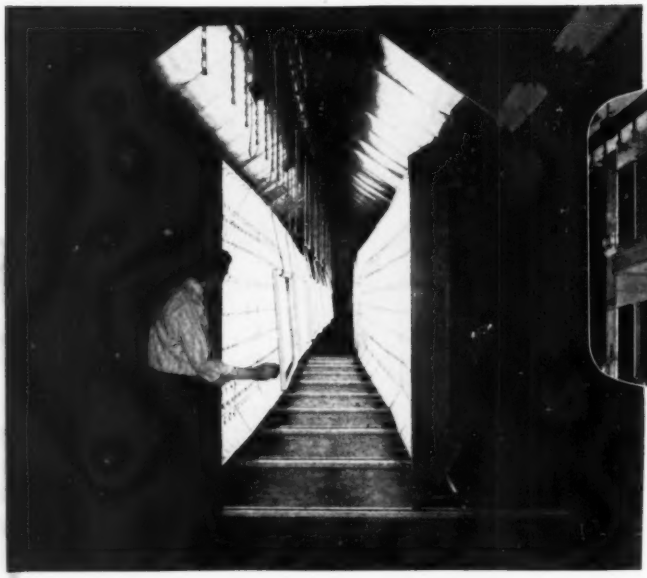
Consumer Booklet

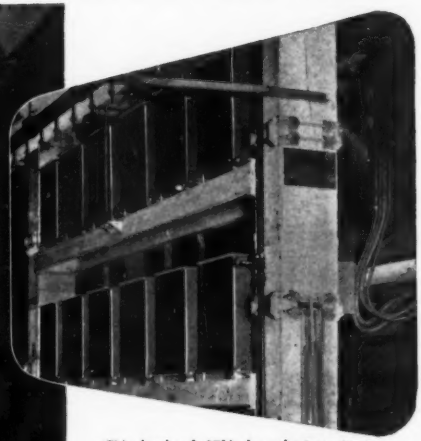
To explain the advantages and uses of G-E remote-control wiring to your customers and prospects, General Electric has prepared an 8-page booklet. This booklet will help you show customers exactly why and where remote control should be used. For a copy of the Remote Control Consumer booklet and information on obtaining it in quantity, see your G-E Construction Materials distributor, or write Section D56-518, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

ALLIS-CHALMERS
Dry-Type
Transformers

Step Down Voltage RIGHT AT LOAD





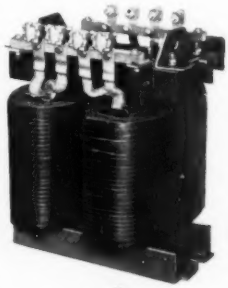
This bank of 37½ kva dry-type transformers is used to supply power to an infra-red lighting installation (shown at left) used for drying painted panels.

The transformer gives new flexibility in matching changing loads. Whenever lighting is altered or machines are relocated, it can be moved quickly because of its lightweight.

IN MEETING TODAY'S EMERGENCIES you may have to convert some of your plant operations almost overnight. This will mean rearranging plant layout, relocating machines, altering lighting and power services. For such conversions you'll find Allis-Chalmers dry-type transformers can be installed in a few minutes, thus preventing costly delays and bringing power close to the load.

"The most practical transformer I ever installed" is the way many an engineer has described the Allis-Chalmers dry-type transformer. These transformers are lightweight, small in size — they're built with heat resisting "Fiberglas" insulation. You can mount them on platforms, posts or on the machine itself. Solderless connectors on all popular sizes reduce hook-up time.

Spotting the transformer close to the load keeps secondary feeders short, helps you get full use of the power you buy. You will welcome savings in hard-to-get copper conductors and reduced power losses. The dry-type transformer helps you put rated voltage right up to the motors and lighting equipment — speeding up motor starting and improving voltage regulation. By operating motors, lights and other equipment at rated voltage you obtain more efficient performance.

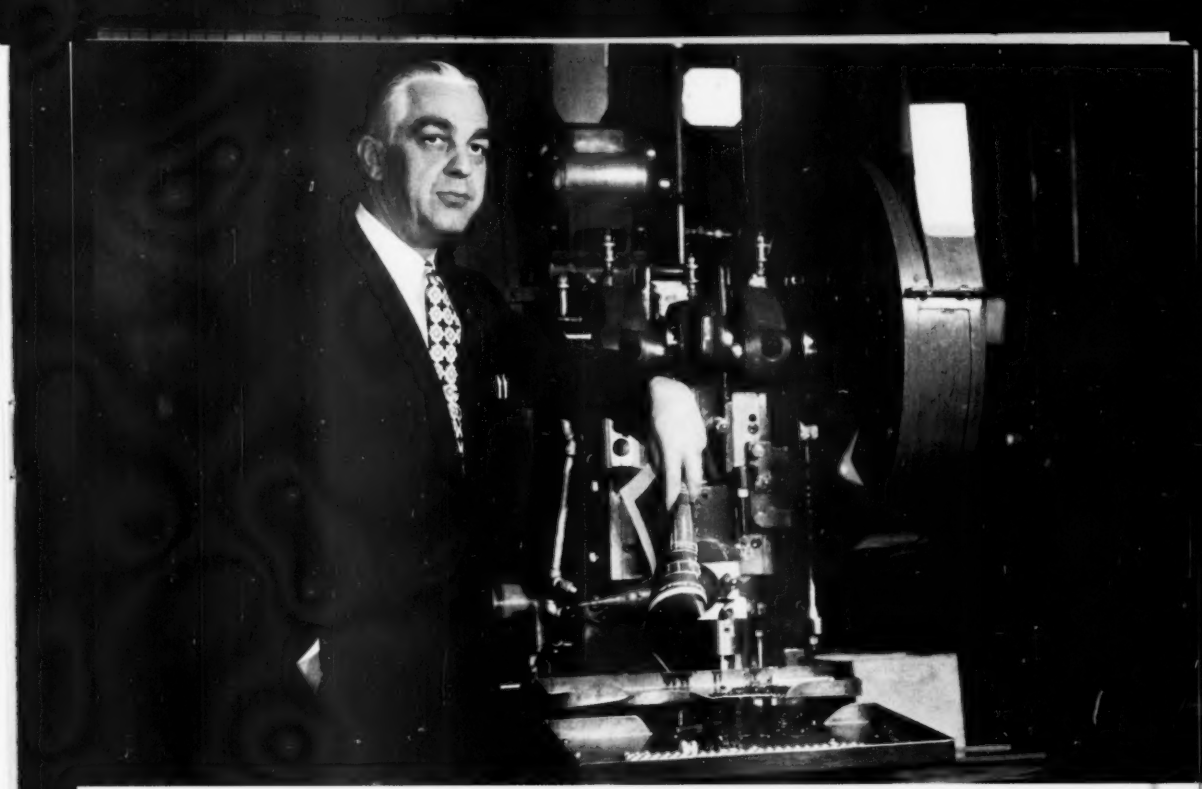


Transformers are rated up to 300 kva, 600 volts and below. For more information about dependable Allis-Chalmers dry-type transformers, call your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3361

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

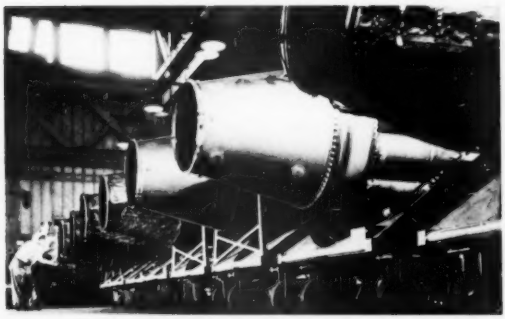
Pioneers in Power and Electrical Equipment from Generation through Utilization



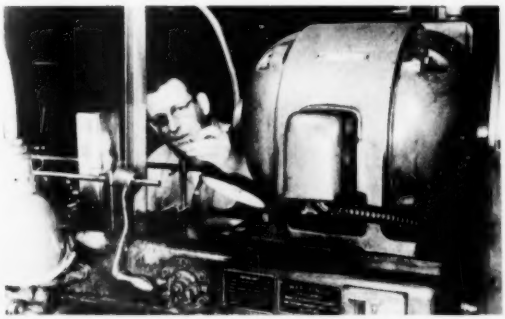
FRED A. HOFMANN, production vice president of the Elastic Stop Nut Corporation of America, says, "We're back on a full 2-shift production schedule, and practically every one of the 62 Tri-Clad motors we've installed since 1941 in our plant at Union, N. J., is going night and day. Sure, we make a lot of steel products But for a general-purpose motor, we don't think you can beat cast iron. After the pounding we've given our Tri-Clad motors for the past 10 years, we're stronger than ever for Tri-Clads."

ELASTIC STOP NUT CORPORATION:

"We're stronger than ever for Tri-Clad triple protection!"

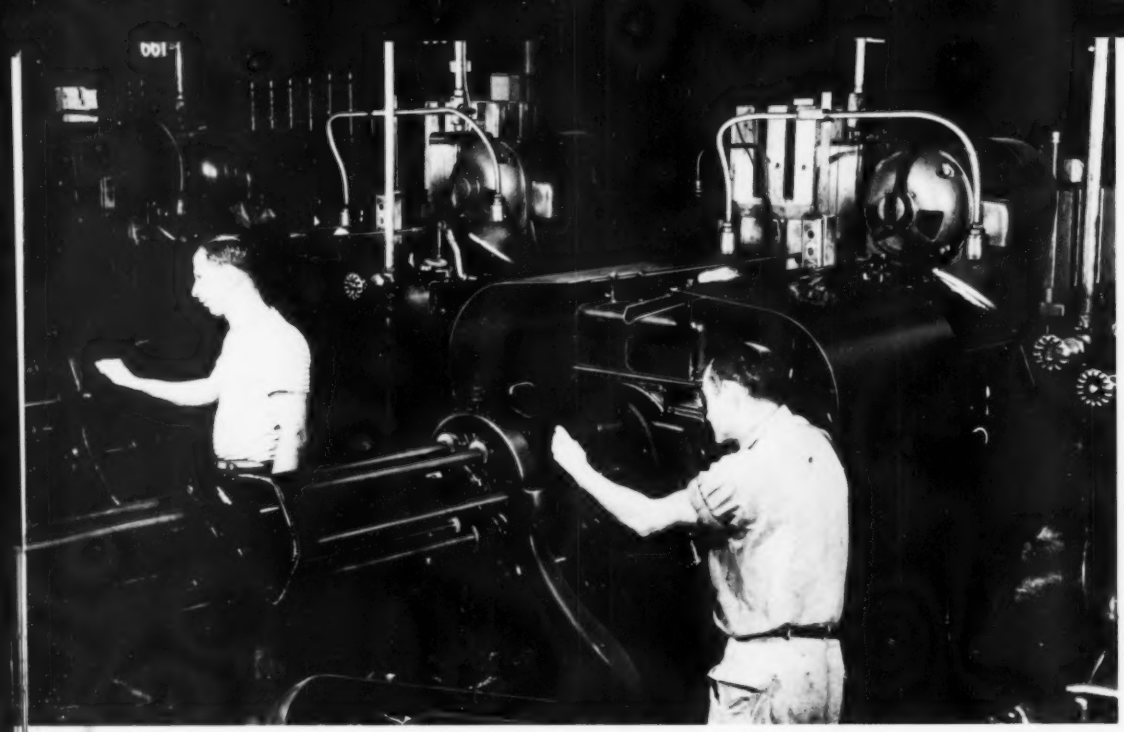


TRI-CLAD MOTORS drive machines that produce ESNA fasteners for use on jet aircraft engines—the engines that power our modern military planes. Each of the jet engines above uses a large number of these special stainless-steel high-temperature nuts, designed to hold under the extreme heat and other severe conditions of jet-engine operation. Moreover, these nuts must be re-usable without seizing or galling the finish. ESNA counts on the reliability of their Tri-Clads to help turn out thousands of these fasteners every day.



VIRILE VETERAN. This 10-hp Tri-Clad motor has been driving an Acme Gridley multiple spindle bar machine for nearly 10 years. It's still going strong, another reason why, after 10 years, ESNA thinks Tri-Clad is still their best motor buy! And today's Tri-Clad motor, all-industry favorite, is better than ever!

GENERAL ELECTRIC



4 STEPS—AND NO HANDS! Backbone of the ESNA production line, the Acme Gridley automatic bar machine (3 shown above) ejects a finished nut blank every 4½ seconds. The operator simply keeps the six spindles supplied with bar stock. The machine feeds stock, machines the nut profile, drills 2 holes and cuts off to accurate lengths. The load on the 10-hp drive motor is heavy and constant—but Tri-Clad, with its bearings completely enclosed in cast-iron housings, can take it! Maintenance department can't recall a single Tri-Clad bearing ever having to be replaced. Moreover, if they need it, the motors are easily geared while running.

GE

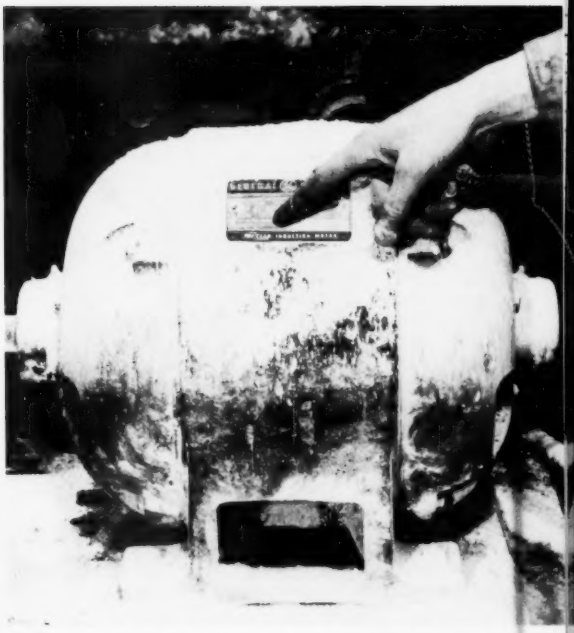
TRI CLAD MOTORS

REG. U.S. PAT. OFF.

Help Keep ESNA Production Up!

PRODUCTION PUSHER General plant foreman Karl Kjellburg has the job of meeting "impossible" defense program manufacturing schedules. He's counting heavily on automatically fed machines like the Tri-Clad driven V. & O. press on his left, says, "This press inserts over 200 elastic fibre locking collars a minute in a ⅜" fastener. Driving it is a big job for a motor. Our Tri-Clads gave us no trouble during the war. We're counting on them again!"

TROUBLE SHOOTER TESTIFIES Ed Conk, ESNA's maintenance chief, must furnish reliable power wherever it's needed in the plant. He's got some definite ideas about electric motors; says, "We like a motor you can regrease easily *if you have to.* So far, we've had to regrease very few of our Tri-Clad motors. And those were either on hot spots or on particularly tough jobs. The point is—we *could* readily have regreased them all if it was necessary."



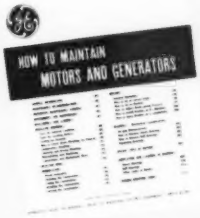
TOUGHEST... on the inside Extra protection against electrical breakdown is built into every Tri-Clad motor. Formex* wire windings, one-piece cast-aluminum rotor, double-end ventilation—these are features that prolong a general purpose motor's useful life.

TOUGHEST... on the outside Teeth rattling blows, dripping liquids, corrosive fumes—they're all in a day's work for Tri-Clad cast-iron construction. You get a rigid structure, too—one that won't twist out of line when you're bolting it down.

TOUGHEST... at the bearings A Tri-Clad motor will run safely without relubrication for as long as any general purpose motor you can buy. But, if the application does make relubrication a "must", you can grease your Tri-Clad without halting production.

** Reg. U.S. Pat. Off.*

How to Keep Your Motors in Shape for the Job Ahead!



TIMELY READING With every electric motor needed on the line, once again it's time to be a crank about motor care. That's why every motor user needs this General Electric manual. Tells how to spot motor and generator trouble before it happens, how to prevent serious breakdown, how to conduct a regular motor maintenance program. Order a copy for your maintenance department today! Use the coupon!

General Electric Company
Section 752-8
Schenectady 5, New York

Please send me my free copy of "How To Maintain Motors and Generators" (GET-1202)

Name _____

Company _____

Address _____

City _____ **State** _____

GENERAL ELECTRIC

Turn the page for the latest news on motor selection and application. ➡

NEED HELP IN TRAINING MANPOWER?

Here's a Valuable Tool! —G-E's New Course on

MOTOR SELECTION AND APPLICATION

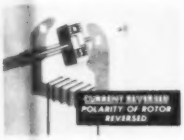
9 Slide Films and Accompanying Manuals To Help You Get the Most Out of Electric Motors

Timed to help meet the growing demand for skilled industrial workers, this new General Electric Motor Selection and Application Course is a boon to everyone concerned with technical training problems. Here, in 9 short, easily understood lessons, is a "how-to" course that offers a broad introduction and review of motor principles and uses to engineers, plant personnel, students and all others concerned with motors. *It's a valuable production-boosting tool for any type plant!* Ask your G-E representative for more details on this course or mail the coupon today.

HERE'S WHAT THIS COURSE CONSISTS OF:

9 Sound slide films and records. 9 Sets of Review Booklets (10 per set) for student use. 1 Instructor's Manual—(This 96-page manual is virtually a complete course in itself.) Complete kit—Slide films, Review Booklets, and Instructor's Manual, in sturdy carrying case—**$100.00.**

Here's a Quick Look at the Scope of the Course



Lesson 1—"Fundamentals of Motors"—Basic principles of motor operation, how a-c and d-c motors work, construction features, etc.

Lesson 2—"Types of Motors"—Horsepower, speed and torque and other characteristics, ranges of application, design features.

Lesson 3—"Fundamentals of Selection"—A study of the five basic steps that are usually followed in the selecting of any motor.

Lesson 4—"A-C Polyphase Induction Motors"—Characteristics of the three basic types: squirrel-cage, wound-rotor, adjustable-speed induction.

Lesson 5—"Single-Phase Integral-HP Motors"—General range of applications, torque and safety factor, capacitor and repulsion-induction types.

Lesson 6—"D-C Motors"—Basic types: shunt, series, compound; horsepower formulas, adjustable speed applications, versatility, etc.

Lesson 7—"Synchronous Motors"—Where used, design features, power factor improvement, and other basic operating benefits.

Lesson 8—"Adjustable-speed Drives"—Speed range and versatility of various packaged adjustable-speed drives, typical applications.

Lesson 9—"Gear Motors"—Selection and application of the three classes of gear units. Advantages of these low-speed drives.

MAIL THE COUPON TODAY!

(Attach this coupon to your business letterhead and mail Today)

General Electric Company
Section 684-20
Schenectady 5, N. Y.

Gentlemen:

Your Motor Selection and Application Course sounds like it may be valuable in our training program.

☐ Send me a complimentary copy of the Course Manual, GEZ-310, for my inspection, at no cost to me.

☐ Send us a complete course for a 10-day free trial. If we do not return the course at the end of the trial period, you are to bill us $100.00 for this complete course.

Name_____

Company_____

Address_____

City_____ State_____

GENERAL ELECTRIC

684-20

Desk Fans

MODEL 362—50-60 cycle, 10" oscillator, 1-speed, delivers 700 C.F.M., opalescent Windsor green finish.

MODEL 1049—50-60 cycle, 10" oscillator, 1-speed, delivers 600 C.F.M., light tan finish.

MODEL 481—25-60 cycle, A.C. or D.C., 10" oscillator, 2-speed, delivers 600 C.F.M. on D.C., blue-gray finish.

MODEL 361—60 cycle, 12" oscillator, 3-speed, delivers 950 C.F.M., black wrinkle finish.

MODEL 1249—50-60 cycle, 12" oscillator, 2-speed, delivers 850 C.F.M., opalescent Windsor green finish.

MODEL 1251—50-60 cycle, 16" oscillator, 3-speed, delivers 1500 C.F.M., glossy black enamel finish.

MODEL 1649—50-60 cycle, 16" oscillator, 3-speed, delivers 1250 C.F.M., opalescent Windsor green finish.

Exhaust Fans

NEW Model V-320A Challenger Vent Fan—50-60 cycle, 20" guarded blade, rubber mounted, delivers 3300 C.F.M., black wrinkle finish, operates in either vertical or horizontal position.

Model V-310, V-312, V-316 Challenger Vent Fans—10", 12" and 16" models, deliver 600, 850 and 1500 C.F.M. respectively, light in weight, easily mounted in walls of light construction.

Model V-108 Signal Ring Type Vent Fan—feather-weight model can be mounted on wallboard, features 10" quiet-type fan blade and cast aluminum mounting ring, delivers 700 C.F.M.

Model V-312, V-316, V-318 Signal Backdraft Blade Exhaust Fan—12", 16" and 18" models, deliver 840 C.F.M. zero static pressure—1200 C.F.M. free air delivery, 1260 C.F.M. zero static pressure—1800 C.F.M. free air delivery, 2030 C.F.M. zero static pressure—2900 C.F.M. free air delivery respectively; has fully enclosed, shaded pole, thrust-type ball bearing motor, operates in either horizontal or vertical position.

Model V-1244 Signal Backdraft Blade Exhaust Fan—24" model, 2-speed, delivers 4000 C.F.M., has ¼ h.p. thrust type ball bearing capacitor motor, operates in either horizontal or vertical position.

Pedestal Fans

MODEL P-1251—50-60 cycle, 16" oscillator, 3-speed, delivers 1500 C.F.M., blue-gray wrinkle finish, telescopic floor stand provides height adjustment from 4' 6" to 7' 6"—floor to center of fan.

MODEL CF-20A Air Circulator—60 cycle, 20" blade, 2-speed, delivers 3300 C.F.M., telescopic floor stand provides height adjustment from 4' 4" to 7' 6"—floor to center of fan, wing nuts allow fan to be tilted—varying angle of operation from vertical to 15 degrees below horizontal, in 15 degree angles.

Floor Fans

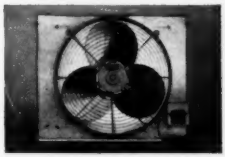
MODEL F7-12 Secretaire—50-60 cycle, 12" floor fan, 3-speed, delivers 2400 C.F.M., beverage resistant, hand-rubbed, wood cabinet, walnut finish.

Kitchen Vent Fans

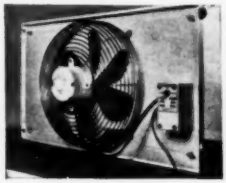
MODEL V-50A Wall Fan—50-60 cycle, 10" blade, 1-speed, delivers 650 C.F.M., finish inside frame and door white baked enamel, balance brown enamel, shutters aluminum. Available in A.C. or D.C. models and to fit wall thicknesses up to 24".

Window Fans

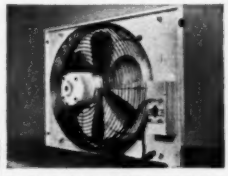
MODEL W-101—50-60 cycle, 10" blade, 1-speed, switch in cord, delivers 700 C.F.M., non-reversible.



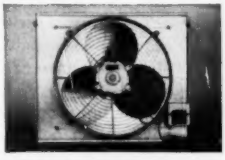
MODEL W-201—50-60 cycle, 20" blade, 3-speed, switch on panel, delivers 3300 C.F.M., non-reversible.



Model WR-122 Electrically Reversible Window Fan—50-60 cycle, 12" blade, 1-speed each way, switch on panel, delivers 900 C.F.M. in both directions.



Model WR-162 Electrically Reversible Window Fan—50-60 cycle, 16" blade, 2-speeds each way, switch on panel, delivers 1500 C.F.M. in both directions.



Model WR-202 Electrically Reversible Window Fan—50-60 cycle, 20" blade, 2-speeds each way, switch on panel, delivers 3500 C.F.M. Exhaust (intake slightly less).

MAIL THIS COUPON TODAY!

There's a heap to please every one of your customers!

It will pay you well to sell Signal and Coolspot Fans in '51 . . . for Signal Fans are built to SELL and STAY SOLD! They don't come back for repairs which eat away your profits. Get the Signal story today!

Signal Electric Mfg. Co., Menominee 8, Michigan

RUSH complete information and discount schedule on the SIGNAL-COOLSPOT Fan Lines for '51.

I am: (Check one) ☐ Dealer* ☐ Distributor

Name _____

Address _____

City _____ State _____

*If Dealer, give us name and address of your Distributor _____

_____ 8

SIGNAL ELECTRIC MFG. CO. • MENOMINEE 8, MICHIGAN

More than America spent to win its Independence

THE Revolutionary War lasted 8 years and its direct cost was $74,555,642.

This sum is considerably less than the amount Youngstown is spending on expansion--its share of the steel industry's program to help preserve America's 175-year-old freedom from Communistic attack.

Work on a $90,000,000 construction project at the Indiana Harbor Works, East Chicago, Indiana, is under way. It includes a 1500-ton blast furnace, 75 new coke ovens and 8 - 250 ton open hearth furnaces, heating furnaces, a high-lift blooming mill, with 6 - 3 hole recuperative soaking pits, ore dock extension, unloaders and ore bridge, and a vast array of other facilities needed to produce the additional 1,000,000 ingot tons of steel involved. By the end of 1952, the steel industry expansion program will raise the total steel producing capacity of the United States to over 117-million ingot tons. This is more steel than is made in all the rest of the world combined.

This tremendous investment by the shareholders of private industry is possible only with adequate profit--profit earned in the past and to be earned in the future. This is a symbol of public confidence--confidence that the American system of free enterprise is right *and worth saving.* Confidence that it will continue to be our way of life through the years ahead.

Scrap Metal is Critical Again

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

Lowest priced...Immediate deliveries

NO MORE WAITING for factory-assembled distribution panelboards! It takes only a few minutes to assemble Federal Noark Flexunit Plug-In Distribution Panelboards from your wholesaler's stock of standard parts. You can provide for future circuit expansion . . . and because of mass production, Flexunits sell for the lowest prices obtainable.

Five standardized surface cabinets in three sizes of mains (200, 400 and 600 amp.) provide for a maximum of:

★ Twenty-eight 30 amp., 3 pole, or eighteen 60 amp., 3 pole, or fourteen 100 amp., 3 pole or three 200 amp., 3 pole, 230v. branches can be combined in one panelboard.

★ Other combinations of 30, 60, 100, 200 amp., may also be assembled in a Flexunit Plug-In Distribution Panelboard.

★ Filler plates to cover unused spaces are available in four sizes.

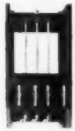
Order Flexunit Plug-In Distribution Panelboards from your Federal Noark wholesaler for fastest service and lowest prices. Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

ASSEMBLE FLEXUNIT DISTRIBUTION PANELBOARDS FROM YOUR WHOLESALER'S STOCK

1 Chassis has 3 silver-plated copper bus bars arranged on edge to receive plug-in units.

2 Rugged plug-in Federal Noark Flexunits are complete with fusible pull switches.

3 Snap! . . and Flexunit is in place. Secured by screws, Wurdack pull switch units are ready to operate.

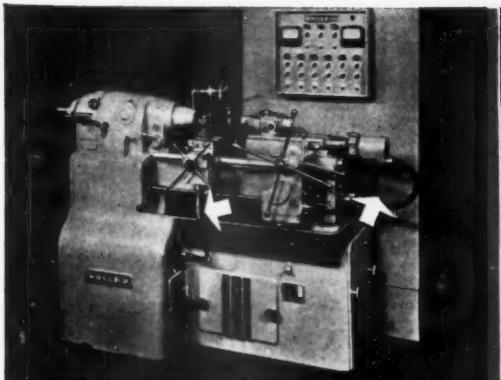


4 Mounted in this chassis are 2 plug-in Flexunits. Unused space can be covered with filler plates.

5 Note ample gutter space available when chassis is mounted in the box. Complete panelboard above.

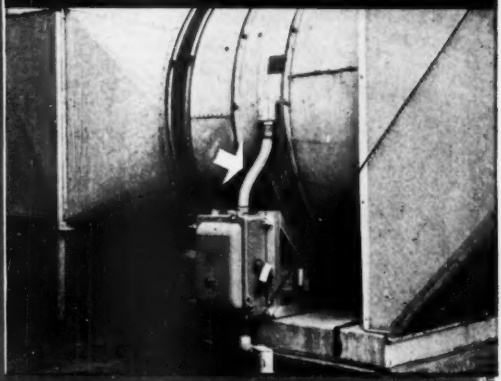
FEDERAL NOARK

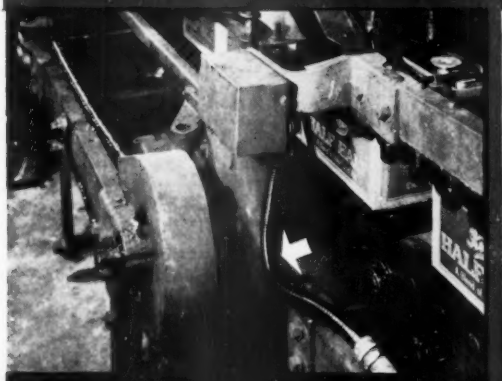
Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.



Control wiring on machines. Sealtite is the ideal conduit for machine tools, motors, short radii bends and wherever wiring must be protected against water, oil, grease, chemicals or abrasives.

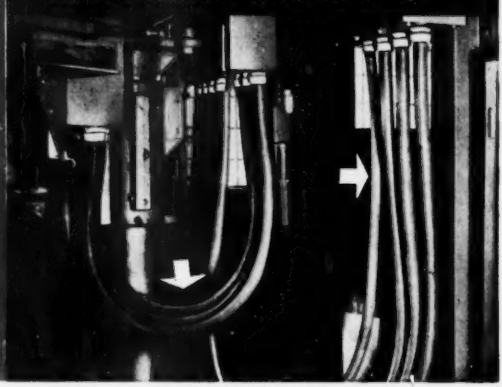
For minimizing vibration between switch-control box and ventilating fan on rooftop, Sealtite is equally at home on inside installations and outside uses, such as this.





Complete protection is supplied by Sealtite for wiring between rigid conduit and trip switch operating conveyor of this beer case gluing machine.

Movable-head junction box connection to stationary junction box on boiler welding jig. Flexibility permits timesaving installation. Sturdy construction of Sealtite assures full protection, avoids expensive rewiring.



Upper Left: *Photo Courtesy: The Monarch Machine Tool Co., Sidney, Ohio.*
Lower Left: *Photo Courtesy: The Kealey Brewing Co., Chicago, Ill.*

Upper Right: *Photo Courtesy: Pacific Gas & Electric Co., San Francisco, Calif.*
Lower Right: *Photo Courtesy: Kewanee Boiler Corp., Kewanee, Ill.*

Sealtite®, the completely flexible, liquid-tight conduit simplifies all types of electrical connections involving motion or vibration—especially to motors and portable equipment. Its flexibility dampens vibration, makes short radii bends.

Sealtite's synthetic jacket can resist oil, water, most chemicals, steam and abrasion. Its tough steel core stands up under impact.

Your electrical supply house carries Sealtite. If you would like more information, send in the coupon today.

61225

SEALTITE

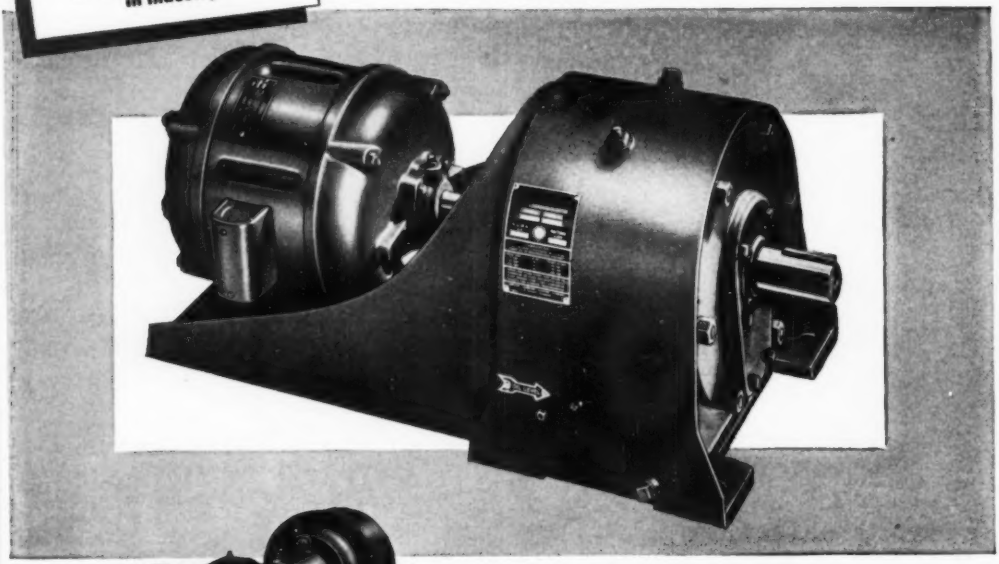
AN ANACONDA PRODUCT

For complete information on Sealtite Conduit, write for Bulletin C-188 to The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut
In Canada: The Canadian Fairbanks-Morse Company, Ltd.

NAME _____ COMPANY _____ STREET _____ CITY _____ ZONE _____ STATE _____

Wagner
ELECTRIC MOTORS
... the choice of leaders in industry

Need "slower than motor speeds"?



Wagner
GEAR MOTORS

available in ratings from 1/20 to 50 horsepower

You can solve your speed reduction problems — reduce costs, improve your product, and increase your plant efficiency by using Wagner Gear Motors to provide smooth transmission of power in place of outmoded belts, pulleys or chains. They combine Wagner Motor dependability with nationally-known gear units to give you positive reduction with the right power wherever "slower than motor" speeds are required.

The Wagner line of gear motors includes ratings from 1/20 to 50 horsepower with gear ratios to meet every requirement. Their flexibility of mounting provides an exceptionally large number of combinations to meet particular needs.

Write for information on Wagner Gear Motors, or consult the nearest of Wagner's thirty-one branch offices for competent advice on motor drive problems.

®Wagner Electric Corporation
1891 WE 1951

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

M51-6

Frustrated farmers

The rapid electrification of American farms during the last two decades presented special problems to manufacturers of wire and cable. For one thing, farm wiring was expected to withstand the severe service conditions existing in barns, stables, root houses and similar outbuildings—conditions involving moisture, poor ventilation, ammonia-laden air, mold, mechanical abuse and alternate exposure to both warm and freezing temperatures.

The non-metallic sheathed cable available for farm wiring proved to be highly unsatisfactory. Its fibrous jacket rotted rapidly, in some cases less than a year after installation. "Hot" wires became exposed. Fire was a constant hazard. Insurance rates soared. Farmers didn't like it. They demanded—and deserved—something better. *Obviously,* someone had to develop a farm wire that could "take it."

PIONEERING IS SIMPLY DOING THE OBVIOUS ***FIRST***

wanted action

SO...NE-o-PRENE LOOMWIRE*

NON-METALLIC SHEATHED CABLE

was developed

National Electric Products Corporation recognized the need for more satisfactory farm wiring and so intensified its development efforts in this direction. The old cable was completely redesigned. The result was NE-o-Prene Loomwire, the *first* neoprene non-metallic sheathed cable to be listed and approved by Underwriters' Laboratories, Inc. for use in wet locations. Since that time, using the design and construction originated by National Electric, other manufacturers have placed neoprene jacketed cable on the market which has met with U.L. approval. But *with the standards set by NE,* the frustrating problem of farm wiring has been solved.

For more than 40 years, National Electric has "set the standard" for everything in wiring—the world's largest producer of the *complete* line of secondary electrical distribution systems.

*Reg. T. M., N. E. P. Corp.

Construction Details

COPPER CONDUCTORS
NEOPRENE INSULATION
SPECIAL RUBBER SPACER
FIBERGLAS BRAID
NEOPRENE JACKET

EVERYTHING IN WIRING POINTS TO

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PRODUCTS CORPORATION
1301 CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.

NO OTHER TESTER

does so much...so well!

WESTON
Model 785
INDUSTRIAL CIRCUIT TESTER

In the shop . . . 28 ranges *in one case* to locate circuit troubles on production equipment.
On the bench . . . 28 ranges *in one case* for checking electrical equipment during manufacture.
In the lab . . . 28 ranges *in one case* immediately available for research and development work.

28 Instrument Ranges

D-C VOLTS: 100 mv, 1/10/50/200/500/1000 volts (20,000 ohms per volt).
A-C VOLTS: 5/15/30/150/300/750 volts.
D-C CURRENT: 50 microamps; 1/10/100 milliamps; 1/10 amps.
A-C CURRENT: .5/1/5/10 amps.
RESISTANCE: 3000/30,000/300,000 ohms; 3/30 megohms.

Stock Accessories Available for Extending Above Ranges

It does *so* much, *so* well, for *so* little. Check your Weston Representative for full details or see your local jobber. Weston Electrical Instrument Corporation, 589 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue Instruments.

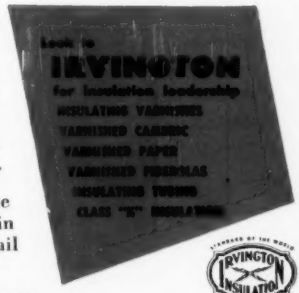
WESTON *Instruments*

Albany • Atlanta • Boston • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Jacksonville • Knoxville • Little Rock • Los Angeles • Meriden • Minneapolis • Newark • New Orleans New York • Orlando • Philadelphia • Phoenix • Pittsburgh • Rochester • San Francisco • Seattle • St. Louis • Syracuse • Tulsa • Washington, D. C. • In Canada, Northern Electric Company, Ltd., Powerlite Devices, Ltd.

For motor repairs that end *re-repairs*
I. R. Nelson counts on HARVEL 612-C Varnish

When a motor repair job *must* stand up under the toughest operating conditions, leaders in every branch of industry turn to I. R. Nelson Company of Newark. For years, Nelson has been known for motor repairs "when it's too important to gamble."

Naturally, Nelson won't gamble on the quality of the repair *materials* it uses! Its consistent choice for insulating varnishes is Harvel 612-C—because this varnish has proved, over and over, on Nelson's most exacting repair jobs, that it withstands severest service. Prolonged high temperatures do not affect its dielectric strength or flexibility. It offers outstanding resistance to acids, alkalies and oils. *And* Harvel 612-C—like other Irvington internal curing varnishes—saves time and money on quality repair jobs in shops all over the country . . . it bakes quickly and easily to a tough, strong coating.



For most effective results with Irvington Varnishes, get our free Varnish Selector Chart. It gives full technical data to assist you in *selecting* the right varnish—and *using* it to best advantage. Mail coupon for your chart and detailed information on Harvel 612-C.

WISE MOTOR USERS PATRONIZE QUALITY REPAIR SHOPS

Send this convenient coupon now

Irvington

VARNISH & INSULATOR COMPANY

Irvington 11, New Jersey

Irvington Varnish & Insulator Company
6F Argyle Terrace, Irvington 11, N. J.
Gentlemen:
Please send me your Varnish Selector Chart and literature on Harvel 612-C.

Name..... Title.....

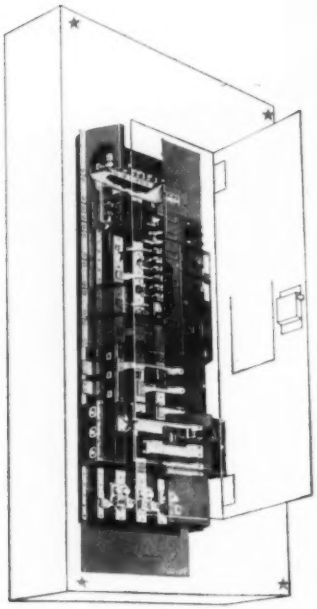
Company.....

Address.....

City..... Zone..... State.....

PRODUCTION CHANGE-OVER TIME WON'T MELT AWAY WITH...

Screwdriver Convertibility



Outmoded circuit protection and slow change-over can inflict double penalty on production schedules today.

It's easy to make necessary circuit changes on the job with Westinghouse Circuit Breaker Panelboards—safely, quickly.

First, indicating trim clamps make it easy to get the trim off. Since change-over parts are die-dentical, a precise fit is insured. Pretapped busbars and back pans eliminate any necessity for drilling, tapping or machining.

Screw driver convertibility is a feature of the big Westinghouse Nofuze® Convertible Distribution Panelboard, but is also available in all Westinghouse "De-ion®" Panelboards.

For complete information call your Westinghouse representative, or write for DB-30-930 containing complete data on Westinghouse Lighting and Distribution Panelboards, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

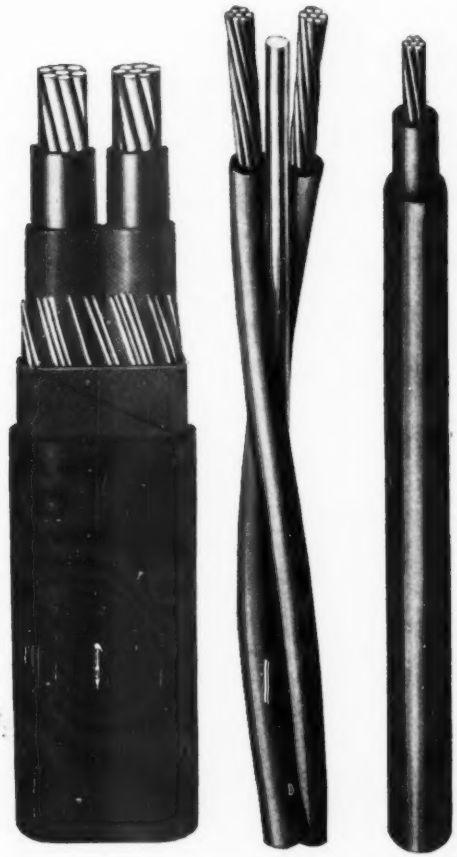
J-93467

YOU CAN BE SURE.. IF IT'S

Westinghouse

PANELBOARDS

SERVICE ENTRANCE CABLES



TYPE SE TYPE SS TYPE USE

Roebling makes a wide line of service entrance and service drop cables

SERVICE CABLES are an important part of Roebling's complete line of electrical wires and cables. Whatever your requirements for getting electrical energy from the utility's secondary to the meter, the right Roebling underground or overhead cable will give you the fullest measures of dependability...and economy.

All types and styles of Roebling Service Entrance Cable are made in the constructions best adapted for their own particular service range. From copper wires to protective jackets these cables are made entirely in Roebling plants where modern machines and methods assure highest, uniform quality.

A large part of Roebling's complete wire and cable line is required in today's rearmament program. You can count on the Roebling organization and distributors, however, to give you the best possible delivery service. John A. Roebling's Sons Company, Trenton 2, New Jersey.

ROEBLING

Atlanta, 934 Avon Ave ★ ***Boston,*** 51 Sleeper St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St

Here's Help

You demand more and more from your batteries as industry strains its facilities for defense. To help you get more out of these essential tools of production—to choose, use, handle and maintain your batteries without waste— Gould announces the

You Need NOW!

Battery performance can be improved as much as 50%* if these eight points are put into practice:

1. **Buy Your Batteries to Fit the Job.** Purchase of oversized or undersized batteries wastes money, materials and manpower.
2. **Install Your Batteries Correctly.** Connect them properly, ventilate adequately and handle according to printed instructions.
3. **Use Your Batteries Within Designed Capacities.** Overdischarge cuts down battery performance.
4. **Charge Your Batteries Properly.** Use recommended rates of initial, finish and float charges.
5. **Maintain Your Batteries Systematically.** Organize a preventive maintenance program.
6. **Inspect Batteries Periodically.** Tighten loose connections and replace worn cables.
7. **Test Your Batteries Regularly.** Keep a record of cell readings—know the condition of your batteries at all times.
8. **Replace When Necessary.** When you know the condition of your batteries, you can place your orders far enough ahead to insure continuous service.

GOULD'S PLUS-PERFORMANCE PLAN is designed to help you conserve and extend your essential battery power. It is a complete, integrated system of manuals, articles, specifications, bulletins, record cards and charts which give you information on every one of these eight points—explaining and illustrating how to choose, use, install, charge, maintain, inspect and test.

**From tests in the Gould Research Laboratory and performance tests in the field.*

LET THIS PLAN GO TO WORK FOR YOU...WRITE US TODAY!

Any or all of the material available under the Gould PLUS-PERFORMANCE PLAN is FREE to battery users without obligation. A request on your letterhead stating the particular problem or problems in which you are interested, will bring the appropriate literature—and booklet explaining the complete plan—by return mail. Write us, attention Field Engineering Department.

GOULD

STORAGE BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

NATVAR IN BRAZIL

Stators, insulated with Natvar slot cell insulation and varnished cambric tapes, on racks ready for infra-red baking operation.

A corner of the Test Department at Arno, S.A., of Sao Paulo.

This exploded view shows the simple yet rugged construction typical of Arno motors. The motor shown is 1½ hp., three-phase, drip-proof.

Arno, S.A. of Sao Paulo, Brazil, the leading manufacturer of electrical equipment in Brazil, produces most of the motors, and associated power equipment used in South America's largest country.

Like the manufacturers of similar products in North America, Arno realizes the importance of quality electrical insulating materials for unfailing service in the field. It is for this reason they have selected Natvar products for their insulation requirements. Arno motors depend upon Natvar slot cell insulation, varnished cambric tapes.

All Natvar electrical insulating materials are recognized for their high standards of quality and uniformity throughout the world.

- Natvar flexible insulating materials are distributed in Brazil by Casa Rand Comercio E Industria S.A.

P. O. Box 250, Rua Senador Dantas 37, Rio de Janeiro, Brazil
P. O. Box 3619, Rua 24 de Maio 207, Sao Paulo Brazil
P. O. Box 267, D. de Pernambuco-119, Recife, Brazil
P. O. Box 978, Rua Uruguay 91, Porto Alegre, Rio Grande do sul, Brazil

THE NATIONAL VARNISHED PRODUCTS Corporation

Telephone Rahway 7-8800
Cable Address NATVAR: Rahway, N. J.

205 RANDOLPH AVENUE ★ WOODBRIDGE, NEW JERSEY

Natvar

Natvar Products

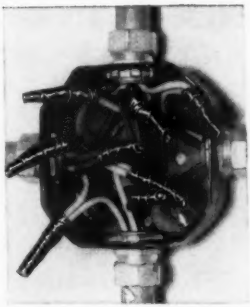
- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

Ask for Catalog No. 21

DUTCH BRAND PLASTIX Electrical Tape

The Quality Tape . . .

for neat splices



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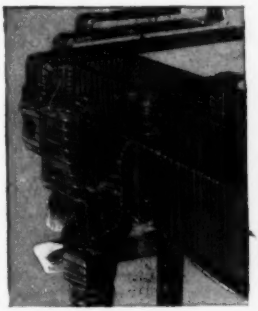


for smooth conformation to irregular surfaces

DUTCH BRAND **PLASTIX** has high dielectric strength for use where space is limited. Thin and strong, it has extra stretch needed to conform readily to irregular surfaces. It is oil, grease and weather proof. It is available in two thicknesses: The regular .007" and the heavy duty .010" thickness. The .010 **PLASTIX** electrical tape being slightly thicker, is for winding heavy cables or electrical harness and for use with power driven taping machines.

For complete satisfaction, order DUTCH BRAND **PLASTIX** electrical tape by trade name . . . specifying either the regular .007" thickness or the heavy duty .010 **PLASTIX**.

Regular PLASTIX

Features These Many Outstanding Qualities

Tears Readily . . . Conforms to Irregular Surfaces . . . Resists Weather (rain and rough weather do not affect it) . . . Resists Oils, Acids, Alkalies, Corrosion . . . High Dielectric Resistance, where space is limited, a single thickness resists 8000 volts which is greater than 1000 volts per mil of thickness. Excellent Adhesion . . . Tensile Strength (has ample strength for all types of applications).

.010 PLASTIX ELECTRICAL TAPE CHARACTERISTICS

All general characteristics are the same as above except .010 PLASTIX is heavier gauge for heavy-duty work.

Thickness .010" A single thickness resists 10,000 volts

the "Dutch Brand" trio

PLASTIX

is one of the DUTCH BRAND Trio of electrical tapes

ORDER FROM YOUR JOBBER

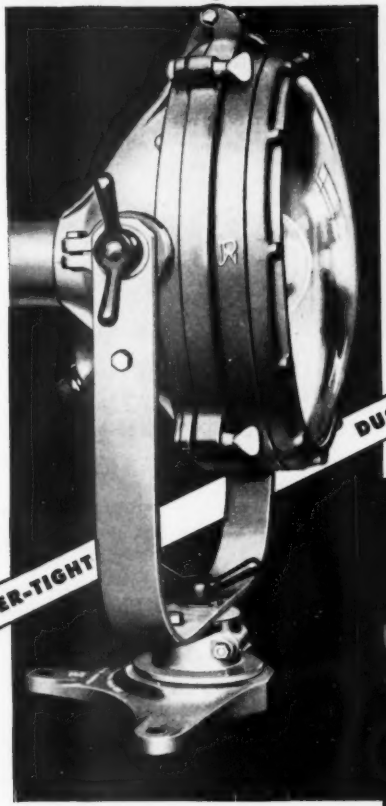
DUTCH BRAND

VAN CLEEF BROS. INC.

Manufacturers . . . Rubber Products Est. 1910

CHICAGO 19, U. S. A.

Consider the years ahead!

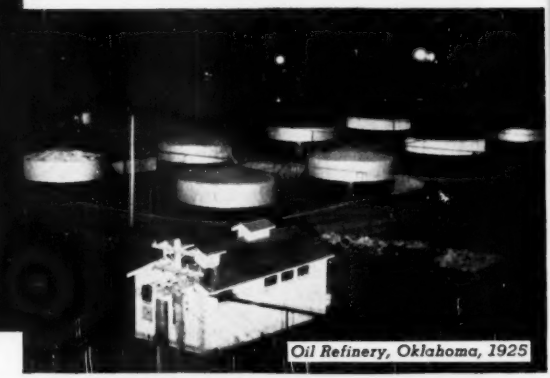


For PROTECTIVE and PRODUCTIVE lighting

Specify

PYLE-NATIONAL

ENCLOSED FLOODLIGHTS


Oil Refinery, Oklahoma, 1925

Don't economize on the initial cost when planning a floodlight installation. It is the elimination of large maintenance, repair and replacement expense that counts.

Sealed against moisture and dirt, constructed throughout of rugged, corrosion-proof materials, Pyle-National floodlights retain their original high-efficiency output throughout an exceptionally long service life, with negligible maintenance and replacement expense.

The earliest Pyle-National floodlighting installations are still operating in excellent condition, with ***over a quarter of a century*** of efficient, economical service to their credit! Convincing proof of the value of quality, enclosed floodlights.

Write for catalog 2100, which gives a complete description of our extensive line of heavy duty floodlights.

The services of our experienced floodlighting specialists are available at all times to advise and assist in installation problems.

THE PYLE-NATIONAL COMPANY

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

District Offices and Representatives in Principal Cities of the United States

Export Department: International Railways Supply Co., 30 Church St., New York.

Canadian Agent: The Holden Co., Ltd., Montreal.

SINCE 1897

CONDUIT FITTINGS • PLUGS AND RECEPTACLES • TURBO-GENERATORS • GYRALITES • MULTI-VENT AIR DISTRIBUTION

THERE'S ONLY ONE WAY TO GET COMPLETE LIGHTING SATISFACTION

Only one way — QUALITY EQUIPMENT. It is the economical way, too. That is why it is best to specify Miller lighting equipment. It is built on an 8-Point standard of quality construction, with engineering features that minimize cost of installation and maintenance.

Thousands of installations, in stores, offices, schools, factories and public buildings, have proven the enduring QUALITY of Miller lighting equipment, and its LOW OVERALL COST — cost of equipment, installation and maintenance — the important point to be considered in planning lighting.

For complete lighting satisfaction, SPECIFY MILLER — one source of supply for QUALITY equipment for the best use of Fluorescent, Incandescent, and Mercury-vapor lighting. Developed on a background for 107 years pioneering and progress in Good Lighting. Miller field engineers and distributors are conveniently located for nation-wide service.

THE miller COMPANY MERIDEN, CONN.
SINCE 1844

ILLUMINATING DIVISION: Fluorescent, Incandescent, Mercury Lighting Equipment
HEATING PRODUCTS DIVISION: Domestic Oil Burners and Liquid Fuel Devices
ROLLING MILL DIVISION: Phosphor Bronze and Brass in Sheets, Strips and Rolls

Another Outstanding FA Installation

Baskerville & Sons, Architects and Engineers, Richmond, Va.
Samuel Hannaford & Sons, Consulting Architects, Cincinnati, O.

LOUISE OBICI MEMORIAL HOSPITAL
and NURSES' HOME
Suffolk, Virginia

Adequate power and light is vital, not only to hospitals and other institutions, but to modern industry. That's why FA products are being installed in more and more institutions and industrial plants.

Architects, engineers, contractors, builders and industrialists know from years of practical experience that FA is a symbol of quality — that its power and light distribution systems, and other products are safe, dependable, efficient, and economical . . . and will provide years of trouble-free service.

The next time you are confronted with a power and light distribution problem, do as so many others are doing; contact your nearest FA representative (he's listed in Sweet's) or write for complete information.

FA Circuit Breaker Panelboard similar to that installed in Louise Obici Memorial Hospital and Nurses' home. Capacities, 15 to 50 amperes, single and double pole, 120—240 volts, three wire, or 120—208 volts, 4 wire main, 42 circuits and less.

FA Shutlbrak Switchboard which has proven extremely popular and practical for hospitals and other institutions. Designed for main feeder and branch circuits. Capacities 30 to 1200 amperes, 250 volts AC or DC and 600 volts AC 2, 3 and 4 pole types.

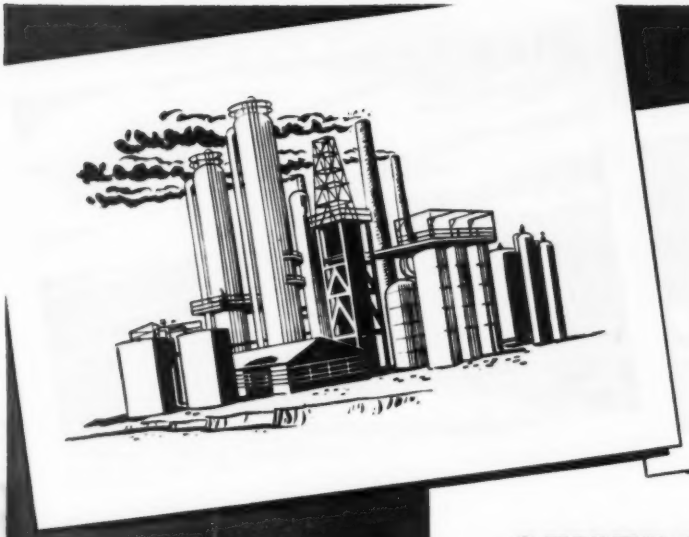
FA TRADE MARK

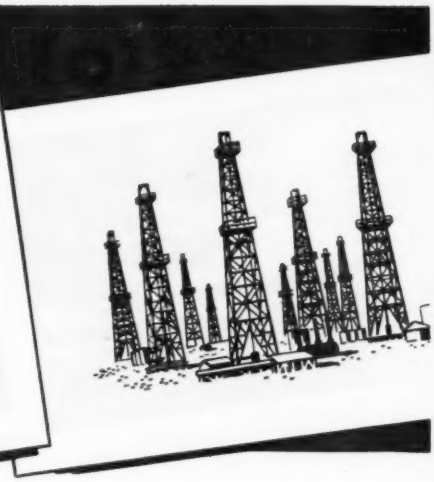
Frank Adam Electric Co.

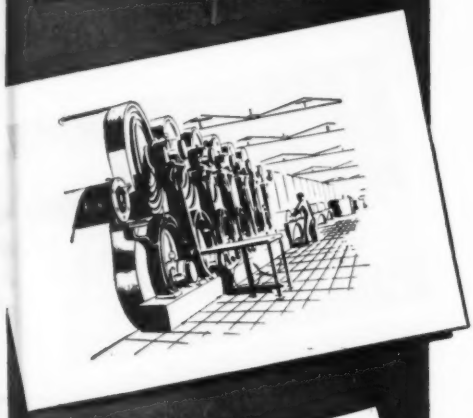
P. O. BOX 357 ST. LOUIS 3, MO.

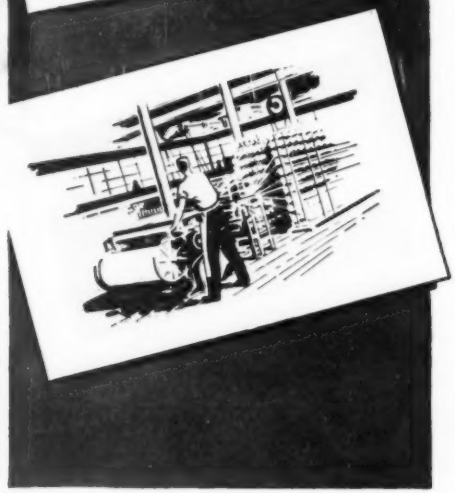
Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

Our 60th Year









GENERAL ELECTRIC are Ready to

As your electric power needs increase, as your distribution problems become more complex—General Electric research, design, and development are constantly at work devising wires and cables for your particular requirements.

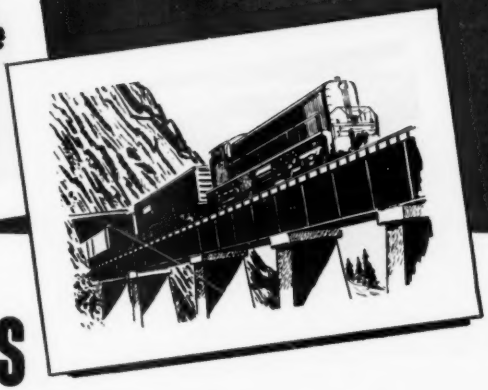
When you need an ozone-resistant cable, or a heat-beating cable, or a durable portable cable, or some other specific type, General Electric is ready to provide the product that's designed and built to do the job best. For example, if you've been looking for a better varnished cambric cable, you will find G-E No. 1799 v-c cable the most satisfactory for your application.

Developing better insulations—finding tougher, longer-lived jacketing material—investigating your requirements—anticipating tomorrow's needs—all are part of the continuing job at General Electric. Important, too, is the task of maintaining the high quality of such dependable G-E names as BX, Deltabeston, Flamenol, Coronol, Geoprene, Formex, and others equally significant.

As *your* power requirements increase, look to General Electric for wires and cables designed to help you do the job properly.

FOR INFORMATION

For information on G-E wires and cables that can help you do your job more efficiently, consult your nearest G-E Construction Materials office or distributor, or write Section W56-518, Construction Materials Department, General Electric Company, Bridgeport 2, Conn.



WIRES and CABLES Meet Today's Electrical Demands

Industrial

Versatol*-Geoprene power cable
Super Coronol* power cable
Deltabeston* AVA power cable
No. 1799 varnished cambric cable
Interlocked armor cable with No. 1799 v-c insulation
Flamenol* bus-drop cable
Flamenol machine-tool wire
Geotrol gasoline-resistant wire

Residential-Commercial

BX* armored cable
Service entrance cable
Flamenol remote-control wire
Flamenol drive-in theater cable

Design

Flamenol flexible cord
Flamenol fixture and appliance wire
Flamenol neon sign cable
Geoprene portable cord
Formex* and Deltabeston magnet wires

Electric Utilities

Gas-filled cable
Oil-filled cable
Pipe cable—oil- or gas-filled
Super Coronol high-voltage cable
Paper-insulated cable
Preassembled aerial cable
Varnished-cambric-leaded cable

Mining

Super Coronol-Geoprene mine power cable
Geoprene portable cable
Deltabeston mine locomotive cable
Flamenol mine telephone cable
Flamenol control cable
Shot firing cord
Formex and Deltabeston magnet wire

Transportation

Flamenol railway signal cable
Flamenol line wire
Flamenol control cable
Deltabeston locomotive cab cord
Car wiring cable
Deltabeston aircraft wire
Shipboard cable

Municipalities

Street-lighting cable
Flamenol traffic control cable
Armored parkway cable
Sports area lighting cable

*Registered Trade Mark of General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

CRESCENT ENDURITE

DUAL PURPOSE WIRE & CABLE

Listed by Underwriters' Laboratories as

TYPE RH—75° C

OR

TYPE RW—60° C

In DRY locations ENDURITE insulated wire and cable with its superior heat-resisting characteristics, is rated as a Type RH with higher permissible operating temperature and consequently greater carrying capacity.

In WET locations this same wire with its excellent moisture-resisting qualities is rated as a Type RW.

Except where voltage drop is the determining factor, CRESCENT ENDURITE when used as a Type RH allows the use of a smaller size of cable and in many cases smaller size of conduit at less cost than would be required for Type R or Types T or TW for the same load.

Usually in sizes No. 6 A.W.G. and heavier for power circuits and No. 1 A.W.G. and heavier for lighting circuits CRESCENT ENDURITE as TYPE RH will give the lowest cost per ampere of useful circuit capacity.

For branch circuits requiring small size conductors, Voltage Drop is the determining factor in the choice of conductor size.

There is also a definite advantage to you in the REDUCTION OF STOCKS as this one wire will meet all your building wire requirements for both the usual dry location and the occasional wet location.

Send for Bulletin giving Comparative Current-Carrying Information

CRESCENT INSULATED WIRE & CABLE CO.
Trenton, New Jersey, U. S. A.

Washington Report

NPA's Controlled Materials Plan goes in July 1. Basically, it duplicates CMP of WPB (War II), with minor differences. Even old form and regulation numbers will apply, but forms will be changed and simplified.

CMP is flexible, well suited to today's dual economy. It will insure defense production, encourage civilian production. Many present controls will be amended to implement CMP, and new regulations will provide equitable distribution of remaining balances of the three basic metals.

NPA industry divisions were recently expanded from 20 to 35. This aligns administrative structure to conform with established industrial organization, makes possible closer working relationship with industry executives in carrying out CMP.

Electrical wiring devices requirements will remain about same as at present during 1951, NPA recently told this industry's advisory committee, meeting in Washington. Committee recommended two task groups: one to make study of industry's problems on materials and essentiality of product, other to investigate materials conservation possibilities of its products.

DO-97 MRO ratings may no longer be used to obtain certain scarce materials, including chemicals, nylon fiber, paint, lacquer, varnish, photographic film, and several others. This was effected through April 16 Amendment to NPA Reg. 4. Further tightening is in prospect.

Low voltage distribution equipment manufacturers are provided with 7500 tons steel for both May and June under special program, to enable them to maintain production of switchboards, bus bar, switches, etc., for industrial plant requirements.

School construction gets 25,000 tons of steel in June through special NPA program, to take care of hardship cases and provide more schools for an increasing population.

Hospital construction program gets spot assistance for up to 16,500 tons of steel during June through NPA special program to assure building of hospitals in areas where present facilities are inadequate.

Electric power utilities are allocated 49-million pounds of aluminum for distribution and transmission lines during 1951's second quarter. NPA Order M-50 authorizes power companies to use DO-48 rating for aluminum wire, cable, bus bar and accessories, establishes rules for use of rating and provides procedure for obtaining MRO materials.

Small businesses may expect a better break from Washington henceforth. DPA has adopted a four point procurement policy to increase their participation in defense production. Department of Defense will implement policy by locating small firms with productive facilities and spreading orders across a wide base. NPA and other agencies are also cooperating.

New Defense Production Inquiry Center, to provide production information to business representatives, is now located in lobby of old G.A.O. Building in Washington, D. C.

Compliance with NPA regulations is being investigated. FTC has already surveyed compliance with aluminum controls, now NPA will spot check a cross-section of 25 business concerns in each industry affected by these controls, NPA Administrator Fleishmann has reported.

"Cuts cost three ways"

with Westinghouse MERCURY lighting

A tank company in Illinois ran cost studies on the new Westinghouse Mercury Lighting System. Results:

1. Operating costs are reduced because mercury vapor produces more light per dollar than any other light source.
2. Maintenance costs are cut because it takes fewer fixtures to produce high levels of illumination than with any other lighting system.
3. Lamp replacement costs are lower, because mercury vapor lamp life is 5,000 hours—5 times longer than the most efficient incandescent lamp.

This is one of hundreds of "time-tested" installations. Investigate the Westinghouse Mercury Vapor Line: 400, 1000 and 3000-watt units for low or high-bay areas . . . open or closed fixtures for clean or dirty locations . . . low or high-voltage ballasts for any distribution system.

Send for B-4727, **"Westinghouse Lighting at Work" in every industrial area.** Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

LIGHTING DIVISION

Edgewater Park, Cleveland

J-04295

. . . . at a Glance

New Leaders

Two electrical industry men rose to the presidency of their respective associations last month. Erne Carlson, of Youngstown, Ohio, was named by the Administrative Committee of the National Electrical Contractors Association, according to constitutional procedure, to fill the unexpired term of the late Edward Vanderlinde. Carlson, long prominent in the IBEW Employees' activities in NECA, is a popular choice and his experience makes him particularly well fitted for the responsibilities of NECA leadership in these critical times. At San Antonio, the National Industrial Service Association elected M. F. Zack of Mason City, Iowa, to the presidency of the motor shop organization. Zack took over from his predecessor, Ed Grant of Nashville, at the largest convention in NISA history. Both of these men take on vital roles in a mobilization economy. We wish them every success.

You know their names well and the chances are you have seen them around. You guessed it—our editorial staff at a recent conference—all good photographers but rarely photographed together. From left to right—"Hi" Phillips, Art Editor; Alice McMullen, Associate Editor; Bill Stuart, Chief Editor; Berlon Cooper, Eastern Editor; Joe McPartland, Reader Service; Gus Eckel, Midwest Editor; and Hugh Scott, Industrial Editor.

DATES AHEAD

Illuminating Engineering Society—Midwestern Regional Conference, Hotel Blackhawk, Davenport, Iowa, May 18-19.

National Association of Electrical Distributors—Atlantic City, N. J., May 21-25.

Illuminating Engineering Society—Great Lakes Section, Hotel Gibson, Cincinnati, Ohio, May 24-25.

Edison Electric Institute—Denver, Colo., June 4-7.

American Institute of Electrical Engineers — Annual summer meeting, Royal York Hotel, Toronto, Canada, June 25-29.

New York State Association of Electrical Contractors and Dealers, Inc. — Annual convention, Saranac Inn, Saranac Lake, N. Y., June 30-July 7.

American Institute of Electrical Engineers—Pacific General meeting, Multnomah Hotel, Portland, Oregon, August 20-23.

Illuminating Engineering Society—National Technical Conference, Hotel Shoreham, Washington, D. C., August 27-30.

International Association of Electrical Inspectors — Southwestern Section, Long Beach, Calif., September 13-15; Northwestern Section, Spokane, Wash., September 19-21; Western Section, Hotel Fontenelle, Omaha, Neb. September 25-27; Eastern Section, Chalfonte-Haddon Hall, Atlantic City, N. J., October 1-3; Southern Section, Hotel John Marshall, Richmond, Va., October 15-17.

International Municipal Signal Association, Inc. — Annual convention, Mark Hopkins Hotel, San Francisco, Calif., September 17-20.

Canadian Electrical Manufacturers Association — General Brock Hotel, Niagara Falls, Ont., September 26-28.

National Farm Electrification Conference — Hotel Gibson, Cincinnati, Ohio, October 9-10.

National Electrical Contractors Association—Annual Convention, Shoreham Hotel, Washington, D. C., October 9-12.

International Association of Electrical Leagues—16th Annual conference, Roosevelt Hotel, New Orleans, La., October 10-13.

American Institute of Electrical Engineers—Fall general meeting, Hotel Cleveland, Cleveland, Ohio, October 22-26.

National Electrical Manufacturers Association — Chalfonte-Haddon Hall, Atlantic City, N. J., November 12-15.

We spot 'em - you nab 'em!

Anaconda is helping spotlight your future and the future of America and her industries with the new, benefit-filled *"Power Up—And Be Prepared"* national promotion.

Every day, week in, week out, this dynamic promotion is convincing industrial plant executives that a strong America requires full-scale production from industry—and full-scale production requires modern plant wiring systems. Help yourself and industry; start promoting *"Power Up—And Be Prepared"* to your own industrial customers.

Here's all you have to do to make *"Power Up—And Be Prepared"* your own promotion.

Get your free Contractor Sales Kit from your Anaconda wholesaler today. Then build your promotion with the direct mail pieces, booklets, letters and sales helps contained in the kit. It also includes your free copy of *"Power Up—And Be Prepared"*—a complete guide to modernizing plant wiring systems.

Industry must power up and be prepared!
You can help them do it. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

51341

the right cable for the job **ANACONDA®**

WIRE AND CABLE

ELECTRICAL CONSTRUCTION AND MAINTENANCE

50th Year —MAY • 1951

Store Switching

LIGHTING FOR MERCHANDISING is evolving through many useful and dramatic lighting effects. The lighting industry is pouring out new luminaire designs inviting new skill in layout and application. The direction of major trends is gradually shaping up and it looks like it is moving away from standardization.

EACH AREA and type of merchandise presents its own challenge to illumination design. For example, housewares, major appliances, draperies, dresses or shoes are displayed most effectively under lighting systems deliberately set up to bring out the most attractive characteristics of the materials.

OPTIMUM LIGHTING effects can be preset by design, layout and adjustment of components controlled by appropriate switching. The methods are like those used in theatrical work. Even with fixed equipment, ingenious circuit arrangements can produce many different lighting results.

SWITCHING AND CONTROL have not kept pace, however, with the rapid progress of lighting. In most store installations, switching is relegated to the branch circuit panelboard. The circuits controlled serve equipment grouped for wiring convenience rather than for providing a variety of lighting effects. Theatrical control principles can be readily adapted to store lighting at slight additional cost and with substantial improvement in flexibility. The elements are 1) functional circuit layout, 2) "magazine" branch circuit panels and 3) master panels.

FUNCTIONAL CIRCUIT layouts provide various levels of general illumination and individual control over supplementary features. For example, 40 fixtures on 4 circuits have every fourth fixture on a circuit rather than 4 groups of 10 contiguous units. Accent, display case, wash and special effect lighting are fed by individual circuits.

BRANCH CIRCUIT PANELS act as "magazine" panels in which the desired lighting effect is preset. Otherwise, these switches or circuit breakers are not operated for switching. Master switches in readily accessible panels provide for daily on and off operation.

COMPACT, STANDARDIZED panelboard designs with interchangeable circuit breakers are particularly adaptable to such installations and offer wide flexibility in wiring layout while still centralizing essential switching control. And master switching on preset circuits has long been needed on modern store lighting systems. An installation of this type now being installed in a Framingham, Massachusetts store may well be an important milestone in wiring system design.

William T. Stuart

Look at Graybar methods — Plan ahead with Graybar for dependable, "on-schedule" deliveries of electrical supplies — you'll find Graybar service hard to beat.

When you order from Graybar, you take full advantage of modern, shortage-beating distribution methods—methods that, even under today's uncertain conditions, will help eliminate delays and keep projects running smoothly.

Graybar's nation-wide warehouse system, up-to-date inventory methods, and carefully selected supply sources reduce the effects of local shortages . . . provide the *fastest possible* deliveries of emergency items.

To speed procurement of electrical items—

Look behind the Graybar tag

Look at Graybar men

Your local Graybar Representative *knows* electrical products—knows how they can best be used. He'll be glad to work with you and your customers in the selection of materials and the practical scheduling of orders. Experienced Graybar Specialists are constantly available to help you solve out-of-the-ordinary problems in all of the major electrical fields.

In addition, your local Graybar office offers a comprehensive catalog and quotation service by competent inside personnel. You'll find it helpful in preparing estimates and meeting job specifications.

Look at Graybar materials

Graybar distributes more than 100,000 different electrical items—products made by 200 of the nation's leading manufacturers.

Subject to defense priorities and regulations, Graybar can supply—on a single order—the necessary materials, equipment and tools for wiring, lighting, ventilation, communication, or power. 161-45

GRAYBAR ELECTRIC COMPANY, INC.
Executive Offices:
Graybar Building, New York 17, N. Y.

Avoid electrical delays—plan ahead . . . via GraybaR

IN OVER 100 PRINCIPAL CITIES

R. W. Murphy, Industries Operations Bureau, N.P.A., Washington, D. C., outlines N.P.A. operation to NISA members.

M. F. Zack, Zack Brothers Electric Co., Mason City, Iowa; **C. J. Covington,** Dowzer Electric Mach Works, Mt. Vernon, Ill.

H. Binner, Central Dist. Chap. NISA; **B. Y. Ferrari,** Excel Electric Service Co., **T. Agosto,** Progress Elec. Co., Chicago.

NISA Meets in Texas

Problems relating to mobilization of resources to meet present emergency conditions took high priority on agenda of the 19th Annual Convention of the National Industrial Service Assn. at San Antonio.

UNDER the present national emergency, the electric motor service industry again faces a short supply in materials and manpower while demands for its services are increasing. As in World War II, the industry is planning to meet this problem without sacrifice in quality of workmanship or service. It was to discuss ways and means of accomplishing this goal that some 650 motor shop operators and their guests assembled in convention at San Antonio's Plaza Hotel, April 15-18. This three-day conference was the largest meeting in the history of the National Industrial Service Association.

Delegates found a healthy mixture of management, personnel, operating and shop "know-how" subjects on the agenda of general sessions and popular round-table forums. From the free exchange of practical experience which highlighted these sessions, delegates took home a wealth of ideas to dovetail into their existing operations.

A record attendance at the opening session heard Vic Braunig, general manager, City Public Service Board, welcome the conference to the city; remind delegates of the advances made in the electrical field over the past half century; note that the cost of electric energy to the consumer remains substantially constant despite large increases in equipment and wage costs.

Two immediately disturbing problems—materials and manpower—were freely aired at this initial session. R. W. Murphy, industries operations bureau, N.P.A., Washington, D. C., outlined the operation and status of N.P.A. as it affected the motor repair shop; emphasized the importance of DO-97 in securing copper and equipment to carry on the repair business. Murphy advised that shops have unlimited use of this order *when extended by their customers* to obtain copper and repair parts to service customer's equipment. He announced that a Controlled Materials Plan will become effective July 1 and expressed the hope that this operation would level off present heavy ordering by the armed forces. Murphy believes that under CMP the inequities of the present system will be eliminated and each one will get his allotted share of raw materials or processed parts.

The shadow of labor migration, encouraged by increased employment and higher wage scales in defense industries, is again hovering over the small business operator. Present price and wage freeze orders practically stymie

Wm. Kauppert, General Electric Specialty Co., Hollis, Long Island, N. Y.; **Herbert W. Engelmann,** J. L. Hemphill & Co., Inc., North Bergen, N. J.; **George R. Lockwood,** Lockwood Electric Motor Service, Trenton, N. J.; **Stanley Bojak,** Standard Electric Motor Rejair Co., Linden, N. J.

W. M. Wheat, Wheat Electric Co., Inc., Springfield, Mo.; **B. C. T. Elworthy,** Elworthy & Co., Ltd., Vancouver, British Columbia, Canada; **W. G. Hall,** Reliance Electric Co., Cleveland, Ohio; **Roy Kornfeld,** Kornfeld-Thorp Electric Co., Kansas City, Mo.

R. E. Ward, Jr.; R. E. Ward, Sr.; and W. S. Ward, Electric Motor & Repair Co., Raleigh, N. C.

George Larsen, Larsen-Hogue Electric Co., Los Angeles, Calif.; **G. E. Jones,** G. E. Jones Elec. Co., Inc., Amarillo, Tex.

E. H. Wheat, Wheat's Elec. Motor Repair, Watertown, S. D.; **G. P. Svendsen,** Boustead Elec. & Mfg. Co., Minneapolis.

J. E. Beyer, Jr. and Mark Hoffman, Hilton Electric Co., Hutchinson, Kansas; **W. F. Weirich,** Lenni Products, Inc., Lenni, Pennsylvania.

William J. Wheeler, Sr., The Maintenance Co., Inc., New York City; **C. R. Durand,** H. N. Crowder, Jr. Co., Allentown, Pensylvania.

J. A. Phares, Southwest Electric Co., Oklahoma City, Okla.; **Myron Evans,** Southwest Electric Co.; **Chris Christiansen,** Dow-Corning Corp., New York City.

the motor shop operator when it comes to meeting outside wage competition. The advisability of having an over-all Wage Plan with well defined job descriptions to cover work classifications in motor shops was emphasized by Roy L. Vickery, labor relations attorney of Kansas City, Mo. Substantiation of wage increases on basis of merit can be more easily presented if an established job classification plan has been in effect. Such a plan would also help when negotiating with a Union, he added, noting that it is equally important to have this for the office and white collar worker as for the shop man. Vickery stated that the wage freeze may be with us for five to ten years (unless the international situation improves considerably) and strongly urged motor shops to establish a carefully analyzed wage plan with provisions for review at least annually to preclude obsolescence.

Quality control, break-even point and collection of slow accounts were among the management subjects presented at the general sessions. Joe Previty, Penn Electric Co., Philadelphia, believes quality control is one answer to elimination of "come-back" work returned to the shop because of defective workmanship. Citing a specific case of a repair shop which virtually went on the rocks because its workmanship and service deteriorated under a non-progressive management, he urged the stimulation of quality consciousness among all shop employees; the use of modern shop equipment and repair techniques; adherence to the NISA Rebuilding Standards as a guide to rebuilding electrical equipment. The hidden cost of inadequate quality control is discernible in the scrap pile, in overtime to meet scheduled delivery dates, in redoing work that failed and in extra sales effort to hold dissatisfied customers, Previty added and emphasized that quality control is a necessary condition for successful management.

Break-Even Point

A continual awareness of the fluctuation of major cost items and its relationship with respect to types and volume of sales is extremely valuable to the motor shop owner. You must know your "Break-Even Point" stated William M. Hogue, Larsen-Hogue Electric Co., Los Angeles, California. In a paper presented before a general session, Hogue developed a simple graphic method of determining this point and knowing the precise profit standing. Using three sets of figures for different sizes of business operations, he plotted total monthly costs against monthly sales volume and noted the break-even point at the juncture of the two curves. Hogue urged each shop owner to prepare such a chart for his own use to answer numerous questions on permissible volume decrease, profit improvement, overhead reduction and other problems.

Collection of slow accounts is another difficult management problem and you cannot antagonize your customer in the pursuit of such collection, advised Frank W. Willey, Willey-Wray Electric Co., Cincinnati, Ohio. Your collector must have patience, perseverance and versatility, he stated in a paper dealing with this subject. Willey recommended establishment of a systematic collection procedure, firm and yet courteous, with a regular follow-up plan; frowned upon instituting recovery suits, except for large accounts. Even then, courtesy and pleasantness pays off, he added, suggesting that delinquent accounts be carefully analyzed before taking rash action.

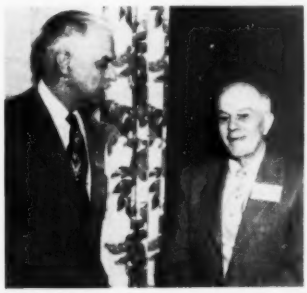
Shop owners interested in repairing and rebuilding of distribution transformers were given an insight into the problems encountered in that field.

E. E. Kolhonen, Peabody Elec. Motor Service, Peabody, Mass.; **J. M. Young,** Anderson-Young Elec. Co., Lubbock, Texas; **H. G. Bedig,** Elec. Maint. Co., Inc., Boston.

Wm. S. Giles, Giles Armature & Electric Works, Inc., Marion, Ill.; **C. W. Nunn,** Swanson-Nunn Electric Co., Evansville, Indiana.

H. Baker, Savannah Refrig. Supply Co., Savannah, Ga.; **L. Watson,** Allen-Bradley Co., Milwaukee, Wis.; **Ed Grant,** Tenn. Elec. Motor Service, Nashville.

L. J. Land, L. J. Land, Inc., New York City; **W. J. Engel,** T. B. MacCabe Co., Philadelphia, Pa.; **Frank L. O'Brien,** The O'Brien Machinery Co., Philadelphia.



Fred B. Wipperman, executive-secretary, NISA, St. Louis, Mo.; **F. T. Broiles,** International Electric Co., Los Angeles, California.

R. E. Trussell, Potter & Rayfield, Inc., Atlanta, Ga.; **T. M. Russell,** Russell Electric Co., Inc., Mobile, Ala.; **A. T. Emery,** Emery Electric Co., Shreveport, La.

Ray Horton, Daley Electric Co., Phoenix, Arizona, presented a paper which dealt with such important items as copper losses, insulation, impedance losses, impedance matching and other factors entering into redesign.

George H. Brown, Insulation and Wires, Inc., St. Louis, Mo., gave the motor shop men an exceptionally comprehensive review of the types and proper application of insulating varnishes. Varnishes are available for every type of electrical equipment, he added, noting that it must be carefully matched to the job. Listed among proper varnish applications were the following: (1) thermosetting for all rotating equipment; (2) thermoplastic for field coils, transformer coils, etc.; (3) air drying for units which might be damaged if baked; and (4) spirit varnishes and sealer types for a high grade protective finish coat for use over baked varnishes. The user must decide on the factors of protection he thinks most important and temper this requirement with the performance characteristics of the equipment.

A comprehensive, illustrated presentation of the application of direct current motors for variable speed drives was given by William G. Hall, Reliance Electric & Engineering Co., Cleveland, Ohio. The operation and advantages of this type of drive were outlined in detail. Hall announced the recent development of a simplified, more compact, lower-cost electronic design of the variable speed drive for ¾ to 3-hp. motors; reiterated the importance of systematic maintenance on any equipment of this type.

Electronic Control

The use of electronic control for motors in the instrumentation and remote control field is virtually limitless in extent, stated John Ohman, research engineer, Southwest Research Institute, San Antonio. Among recent developments he noted the use of rectifiers for dc motor control; maintenance of alternator voltage output in synchronism with a frequency source of low power output through an electronic scheme; phase-angle control through use of a full-wave thyratron rectifier; electronic exciters for large central station generators; rectifier motive power unit for dc traction motors on high-voltage ac trolley systems; and a thyratron voltage control for fractional horsepower dc motors operated directly from an ac line.

Shop men in attendance at the conference were given a complete review of the materials and services available. Ed Grant, past-president and owner of the Tennessee Electric Motor Service, Nashville, listed these as follows: Bookkeeping Made Easy—a simple system of bookkeeping; Rewind Data Books; Technical Manual; Rewind Data Cards; Electric Motor, Generator and Transformer Rebuilding Standards Booklet; Rebuilding Decals; Equipment Bulletin (wanted and for sale listings); Postal Card Service; Fundamentals of Electricity and Shop Fundamentals in lesson form; Uniform Warranty Service Report form (now accepted by 16 motor manufacturers); Information on Government Control; Tax Information; Arbitration services; Supply Sources for Unusual Materials; Statistical Information; Trade Relations; Award Contests and the NISA Open Door Policy of encouraging exchange of ideas between shops.

The round-table forums again took top priority on afternoon activities. Held in separate groups were floor discussions on management; large motor and direct motor repair techniques; small motor operations and forums on transformer repair and rebuilding. Plain talk on down-to-earth shop prob-

(*Continued on page* 193)

INCIDENTAL LABOR

Incidental labor expenses and other direct job costs may approach 20 percent of base cost of material and labor. This study suggests how to insure inclusion of such items in an estimate.

By Ray Ashley
Research and Consulting Engineer
Chicago, Illinois

IN a previous article "Non-Productive Labor—A Misnomer" (April, 1951, EC&M, pg. 62), the fallacy of classifying incidental labor as "non-productive" was discussed. Assuming that the suggested classification of incidental labor is correct, there is still the problem of how it should be presented in the estimate. As we have the same problem regarding direct job costs, the two items of expense can be treated together.

Every office should have check lists, as reminders for the estimators. A complete list for incidental job costs is something one rarely finds in contractors' offices. The contractor, operating near home and on jobs of a similar nature, year in and year out, may get along with estimated percentages to add according to the nature of the work and the volume of the contract. Nevertheless the list of expenses making up these percentages must be available.

Fig. 1 gives a listing of some of the numerous items of direct job expense that may be encountered. In checking these items with Walter Brand of the Newberry Electric Corp., Los Angeles, the writer was advised that each estimator of that organization was provided with a reminder list for checking incidental job expense. Mr. Brand also advised that projects in hot arid sections call for many expenses not normally encountered.

The proper method of listing and charging incidental costs must be left to the estimator. An item of labor may be a definite part of a particular branch of the work on one job whereas it may be a general expense on another. Testing for a signal system should be charged off with other items for the system. Overall testing specified to be carried on in the presence of the owner's representative is general.

An item of cost may be for labor, but for markup purposes it will be listed in the material column. Labor insurance is such an item. There are two reasons why this should be subject to a markup designed for material rather than one for labor. First, the cost of supplying insurance is more in line with the costs for supplying material. Second, one is inviting trouble if he submits estimates or renders bills with too high insurance.

On a medium sized contract for a complete installation the corresponding overhead markup for material and labor would be 10% and 35% respectively. The smart contractor just will not try to collect 35% for overhead on insurances.

Incidentals Are Not Overhead

In spite of all that has been written about keeping direct job expenses out of overhead, it is still in order to

INCIDENTAL LABOR AND DIRECT JOB EXPENSES

EQUIPMENT AND GENERAL

- Engineering
- Drafting
- Blue Printing
- Tools—Consumed and Depreciated
- Scaffolding
- Trucks
- Gas, Oil and Truck Supplies
- Rental Equipment
- Freight & Cartage
- Field Office and Shop Buildings
- Furniture & Equipment (Field Bldgs.)
- Lavatory & Sanitary Facilities (Field Bldgs.)
- Wiring Field Bldgs. (Mat.)
- Wiring Temp.—on the Job (Mat.)
- Light & Power (Bills for Current)
- Job Telephone
- Heating Field Bldgs.
- Ice Water (Appreciable item in some Sections)
- Travel Expenses:—
  - Air, R.R. and Auto
  - Room and Board
  - Special Exp. (For men away from home)
- Rental for Storage Space (Off the Job)
- Painting Materials
- Special Hoisting Charges
- Surveying
- Barricades & Lanterns
- Prorata Charges
- Licenses
- Inspections
- Legal Expenses
- Association Dues
- Interest on Pay-Roll
- Reserve for Contingencies & Guarantee

LABOR

- Supervision
- Travel Time
- Erecting & Removing Scaffolding
- Special Hoisting & Material Handling
- Wiring Field Bldgs. (Labor)
- Wiring— Tem. on Job (Labor)
- Job Engineer
- Job Draftsman
- Time Keeper
- Watchman
- Job Clerk
- Painting (Labor)
- Testing
- Erecting Barricades
- Traffic Control
- Lost Time (Anticipated) due to—
  - a. Bad Weather
  - b. Procurement Failures
  - c. Job Interruptions
- Clean-up

BONDS AND INSURANCES

- Performance Bond
- Special Guarantees
- Property Damage
- Property Damage—Installation Floater Policy
- Fire Insurance
- Builders Risk
- Workmen's Compensation
- Public Liability
- IBEW Benefit Funds
- Federal Taxes
- State Taxes

Notes:
(1) Items of cost should be listed on the estimate sheets where they are best suited. Painting and testing may be identified with a particular phase of the work, whereas engineering, tools, field buildings and similar expenses are listed wth the items of Incidental Direct Job Expenses.
(2) Incidental labor expenses such as watchman and insurances may be listed in the material column of the Direct Job expense sheet. They are items of expense that do not require the same high markup as the mechanics payroll.

FIG. 1—Check list of incidental labor and direct job expenses, like this, should be provided to each estimator to assure inclusion of all such items.

and DIRECT JOB COSTS—Part I

A—DIRECT JOB COSTS

MATERIAL—SERVICE			LABOR SUPPORT		
Items of Expense	Est cost		Items of Expense	Est. cost	
	%	Dollars		%	Dollars
1—Material by contractor Engineering & layout			Tools—consumed & depreciated		
Estimating			Cartage—tools		
Selecting & purchasing			Field office & shop bldgs.		
Follow up & Coord. delivery			Engineering & layout		
Cartage & special delivery			Estimating		
Storage facilities—Field			Drafting		
Field tel.—Prorata			Field tel.—prorata		
Special reports—defense reg.			Supervision		
Association dues			Blue printing		
			Heat & light—field offices & shop		
II—Material by Owner			Power wiring & current—field shop		
Engineering & layout			Travel expense		
Assisting owner's pur. agent			Insurances		
Follow up & coord. delivery			Inspection		
Storage facilities			Prorata charges		
Procurement failures (see note 4)			Association dues		
			Interest on payroll		
			Procurement failures Material by owner—Lab. disruptions (N.-4)		
			Res. for conting. & guarantee		
TOTAL			TOTAL		

FIG. 2—Special forms for figuring direct job costs are particularly useful for selling purposes.

B—OVERHEAD & ADMINISTRATIVE EXPENSE

Items of Operating Costs Not Identified with Any Particular Project

Items of Expense	Check fig.	Est. Cost	
		%	Dollars
Administrative salaries	5.00		
Engineering & est.—missionary work.	0.80		
Bookkeeping—gen.	1.04		
Spec. bookkeeping—ins. & taxes	0.52		
Steno. & tel. oper.	0.45		
Store rm. attendant	0.67		
Utility boy	0.37		
Rent—office	0.70		
Rent—store rm.	0.20		
Light	0.12		
Telephone	0.35		
Office equip. & furniture	0.25		
Stationery, est. forms. & misc. supplies	0.29		
Postage	0.13		
Taxes & legal exp.	0.25		
Advertising	0.20		
Insurance on equip. & misc. exp.	0.65		
Research & time studies			
Adj. factor for vol. fluctuation	0.60		
TOTAL			

1—Percentages compiled from surveys of compl. instlns.—all mat. & lab. by electrical contr.

FIG. 3—Cost items which make up general overhead on $600,000 volume.

mention the importance of having all such items of cost clearly identified with the particular job. Without going into details, three reasons for this can be advanced: (1) it is imperative for accurate estimating; (2) direct job costs are easier to sell than overhead; and (3) it is standard practice in the construction industry.

Figs. 2 and 3 provide listings and spaces for contractors to use in estimating job costs and overhead for a particular job or business. The former is for *direct job costs* and is designed for use in connection with the individual job. The latter is generally used in connection with *overall business operations and costs.*

A study of the items listed in Figs. 2 and 3 establishes the difference between direct job costs and overhead. As this discussion is not on overhead, Fig. 3 is presented for comparison only.

Attention is again called to the fact that the *items of incidental labor are usually productive.* In the long list of labor items shown in the tabulation, Fig. 1, the only really non-productive items are travel time and lost time. A previous article covered the best method of avoiding the use of the term "Non-Productive" at any time, and suggested proper definitive classification of labor items normally covered by this term. A future article will discuss methods of estimating and substantiating incidental and direct job costs.

Protective Lighting Techniques

Light will play an important part in protecting industrial, municipal, and military facilities against sabotage. Here are some basic protective lighting principles, some typical luminaires and effective application techniques.

By Berlon C. Cooper

TABLE I–TYPICAL PROTECTIVE LIGHTING EQUIPMENT

Luminaires	Type	Typical Distribution Characteristics		Description
		Vertical	Lateral	
Enclosed Streetlights	A-I	73° to 78°	30° Lobes parallel; Parallel lobes at 90°	Two-way Four-way
	A-II	70° to 75°	25° (20° to 30°) Lobes approx. 60° from luminaire axis	Four-way narrow asymmetric
	A-III	70° to 75°	40° 30° to 50° Lobes approx 40° from luminaire axis	Medium wide asymmetric
	A-IV	70° to 75°	50° to 90° 60 Lobes approx. 40° from luminaire axis	Wide asymmetric
	A-V	70° to 75°	Same through 360°	Symmetric
Open and Enclosed Floodlights	B-I	10° to less than 18°	Approx. circular (with clear lens)	Very narrow beam
	B-II	18° to less than 29°	Approx. circular (with clear lens)	Narrow beam
	B-III	29° to less than 46°	Approx. circular (with clear lens)	Medium wide
	B-IV	46° to less than 70°	Approx. circular (with clear lens or open)	Medium wide beam
	B-V	70° to less than 100°	Approx. circular (with clear lens or open)	Wide beam
	B-VI	100° and up	Approx. circular (with clear lens or open)	Very wide beam
Searchlights	C-I	Less than 10°	Approx. circular (with clear lens)	Pilot house control
	C-II			Trunion mounting
Fresnel Lens	D-I		180° flat beam	Glare projection
Open Reflectors	E-I		Same through 360°	Symmetric
	E-II			Asymmetric

LIGHT is an important aid in plant protection. With the nation now expanding its productive capacity as part of its defense mobilization program, protection of both new and existing industrial facilities becomes doubly important. Protective lighting is thus a new and expanding market.

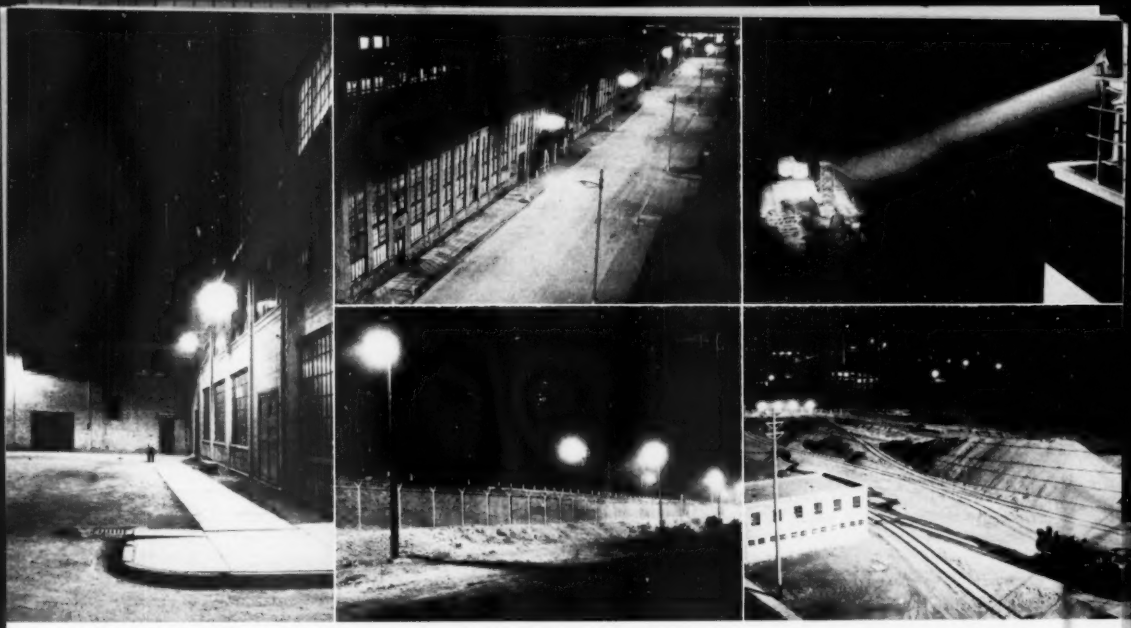
There are many ways in which plants may be protected against saboteurs and would-be intruders. These include installation of high fences around boundaries, electric and infrared alarm systems, use of guard patrols, etc., and protective lighting. But to be fully effective both day and night, all protective measures must be implemented with an adequate and reliable protective lighting system, which should

1. Discourage attempts at unauthorized entry.
2. Make detection of an intruder certain.
3. Aid guards and hinder intruders.
4. Provide adequate illumination of proper design.
5. Discourage theft and prevent damage.
6. Provide complete reliability of entire system.

Basic Principles

The basic principles of protective lighting are few and simple. They include provision of sufficient exterior illumination in the proper locations to enable guards and other authorized company personnel to see quickly all approaches and other areas which are to be protected. The most vigilant police force will lose much of its effectiveness during the hours of darkness if unable to see these areas clearly.

Projection of glare in the direction of potential intruders should be used to conceal guards and to make it difficult for outsiders to see activities



BRACKET-MOUNTED Type A (Table I) units on side of buildings light an internal roadway and area effectively, eliminating all dark corners. 300-watt lamps on multiple circuits are used. Type B units are also applicable. (left)

INTERNAL ROADWAY in large industrial plant uses fluorescent and mercury vapor Type A (Table I) luminaires. Fluorescent 4/96-in. slimline lamp units are on 80-ft. staggered spacings, mounted 30 feet high. (upper center)

FENCED BOUNDARY uses Type A (Table I) units both inside and outside property line, installed on two separate circuits for reliability. Spacing is 150 feet staggered, and 10,000-lumen series lamps are used. (lower center)

INTENSIVE NARROW LIGHT BEAM from searchlight enables watchman in guard tower to investigate an unlighted area inside large industrial plant. Unit is Type C (Table I) with 1500-watt spotlight incandescent lamp. (upper right)

YARD AREA in large industrial property is protectively floodlighted by Type B (Table I) units. Floodlight tower (right, not visible) mounts 1500-watt units 60-feet high, diffuse light over entire area. (lower right)

within the property. Absence of glare should exist in the direction of guard locations. Thus light should be directed toward the boundaries and approaches, and away from the buildings and guard locations. A high degree of vertical illumination is required to produce this needed glare. It can be obtained with units having wide angle light distribution or from other type units tilted to the proper angle.

Small industrial plants will find use for some of the many applications of protective lighting, and large industrial properties and military establishments can adopt most of them. Adoption of the basic principles given here, and altered as dictated by existing conditions, will result in effective protective lighting.

Two Systems

Protective lighting is normally divided into two basic systems, from the standpoint of design and application, or layout. The first, and probably the most commonly recognized, is to light the boundaries and approach areas, leaving the buildings and apparatus structures within the property unlighted. This is particularly applicable for smaller plants where all production is done within the buildings. This system is effective only where the property is served by an adequate guard detail, and assumes that guards will be strategically located in the protective blanket of shadow. It makes use of the glare projection principle primarily.

The second system is based on lighting the complete exterior area within the plant property. It is generally applicable to medium and large size properties, having several buildings and general facilities such as craneways, outdoor storage spaces, railway yards, etc. It is also used in combination with the first system on most large properties.

Types of Equipment

Protective lighting equipment has been classified broadly into five types: streetlights, floodlights, searchlights, fresnel lens units, and open reflectors. This equipment is listed and described in Table I, showing type designations and typical light distribution characteristics for each one.

Streetlights (Type A). Conventional streetlighting luminaires of the enclosed weatherproof reflector-refractor type are well adapted for many protective lighting problems, especially where asymmetric light distribution patterns are needed, and where glare in certain directions would be objectionable. These units are available in a range of light source sizes, for series or multiple circuit operation, for various methods of mounting, and for five general classifications of light distribution. Streetlights have a wide light spread with a positive light cut-off so that glare is minimized to nearby houses, railroads, boats, or highways, and they provide a high degree of vertical illumination.

Floodlights (Type B). Both open and enclosed types of weatherproof floodlights are applicable for many protective lighting problems. Enclosed floodlights are generally preferred, but some large industrial areas, such as storage yards and parking lots can be lighted with open type units where costs must be limited. Hard-glass re-

flectorized lamps are also suitable for some protective lighting applications, and are classified here as floodlight units according to light distribution patterns when installed in a suitable adjustable weatherproof socket housing. Floodlights are nominally operated on multiple circuits only, and are available in a wide range of lamp sizes. They are divided into five types of light distribution.

Wide angle floodlights are used principally for large area lighting where light projection distances are not great—usually not over two to three times their mounting height. Medium angle floodlights are used where light projection distances are up to four times their mounting height, and narrow beam units are used for still greater distances. Floodlights are nominally equipped with clear cover glasses, which provide an approximately circular beam pattern normal to the light beam axis, but may also be equipped with spread lenses for rectangular beam patterns when desired and applicable for more accurate control of the light.

Searchlights (Type C). Supplementary lighting is frequently desirable to enable guards to explore areas inside and outside the plant property and to increase fixed lighting intensities at areas under suspicion. Searchlights, which provide an intensive narrow beam, usually from three to eight degrees, are used for this purpose. Two types of mounting are available, which provide flexible control of beam for any direction: 1) a pilot house control type for mounting on the roof of a guard house, and 2) trunnion mounting for manual control.

Fresnel Lens Units (Type D). These units provide a fan-shaped beam of light approximately 180 degrees in the horizontal, and from ten to 30 degrees in the vertical. They provide a high degree of glare in a horizontal direction, and are usually installed much lower than floodlights to accentuate the glare feature. They should be limited to locations where their light distribution characteristics can be used effectively without disturbing glare to neighboring activities. A 300-watt multiple unit (or 6000-lumen series unit) is applicable for boundary or property-line lighting, while smaller 200-watt and 100-watt units are often used for lighting loading platforms, pedestrian and vehicular entrances, and other close-range lighting of this nature.

Open Reflectors (Type E). In general, open reflectors are not recommended for protective lighting, since they expose the lamp source for easy breakage. They can be used for minor exterior lighting purposes, however, such as for covered platforms, over walkways, in narrow areaways between buildings, etc., where several units would be required, and where pilfering with units would be quickly and easily detected.

Two types of open reflectors are available, symmetrical and asymmetric, each in a range of sizes for different size lamps. Generally, spacings should not exceed 1.5 times mounting height. Asymmetric, or angle types, should be installed with the lamps vertical for protection of the lamp against rain, and are useful for projecting light away from a building, such as over a loading platform.

Equipment construction. Protective lighting equipment, as well as the wiring system, should provide a high degree of reliability. Luminaires should be ruggedly made. They should be heat, dust, water and corrosion resistant. They should be designed for easy maintenance and still provide maximum resistance against tampering by unauthorized persons.

Application Techniques

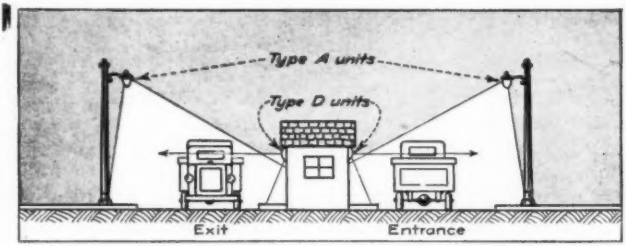
Protective lighting problems will vary considerably from one plant to another. Plant layout, location of buildings with respect to property lines, approaches, and neighboring activities will all influence the design and layout of the system. The terrain of the plant property and adjoining areas, and the method used for patrolling, must also be considered. And the extent to which protective lighting is used will be influenced by (and must be coordinated with) other protective and security measures adopted and in use.

Thus the following recommendations are general, and cover only a few of the more common problems. Each problem should be carefully analyzed in the light of surrounding conditions, and even the basic recommendations given here should be altered accordingly. Luminaire types referred to are listed in Table I.

Boundaries. Boundaries are classified as isolated, semi-isolated, and non-isolated. They may also be considered as fenced, unfenced, water front and building face boundaries.

"Isolated" fenced boundaries are those which are remote from adjacent working areas, roads, etc., and which will permit the use of a "glare projection" system, using Type D luminaires. 300-watt units should be installed 16 to 20 feet high on poles located 10 to 15 feet behind the fence line, and spaced 150 to 175 feet apart.

"Semi-isolated" fenced boundaries are those which are in the vicinity of highways, railroads, etc., where use of glare should be limited. Type A

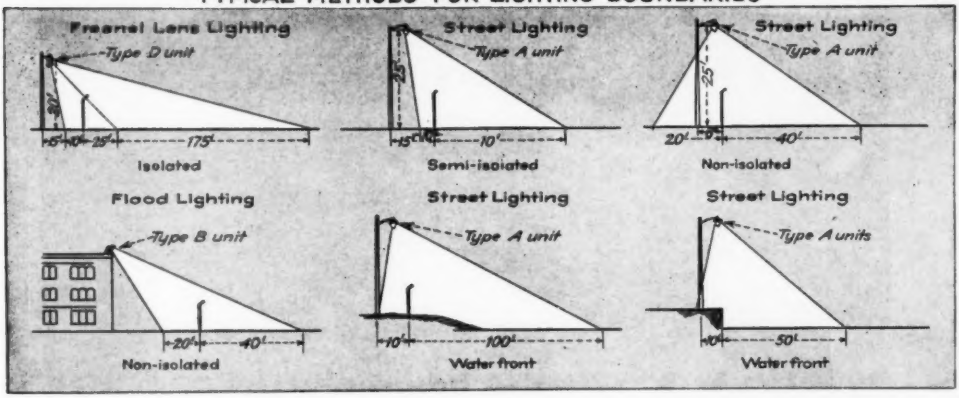


luminaires are generally used in this case. Units with 300-watt lamps installed 25 feet high and up to ten feet inside the fence line, on spacings of 150 feet should provide adequate illumination for this condition.

"Non-isolated" fenced boundaries are those located in active areas, where the public is permitted close to the boundary line outside. More illumination is required for such boundaries, as guards probably patrol the boundary in the lighted area itself. Either Type A or Type B luminaires may be used for this application. Type A units should be equipped with 300-watt or 500-watt lamps, installed 25 feet from the ground on poles at or not over six feet inside the fence line, and spaced 125-150 feet apart. Type B units of 500-watt size should be installed 30 to 35 feet above ground on poles (or buildings) spaced 250-275 feet apart, with two units per location or pole. These may be installed up to 30 feet inside the boundary line.

"Unfenced" boundaries are property lines on which no fence is provided, and are usually close to the plant buildings. Seldom is critical defense work done in such plants. If protective lighting is wanted for such plants, the lighted strip should extend out at

TYPICAL METHODS FOR LIGHTING BOUNDARIES



least 80 to 100 feet from the face of the building inside the property, and Type B units can be used successfully for this application, installed on the roof of the building, or at least 25 to 40 feet above ground.

"Building face" boundaries are those in which the public may approach the building, and are usually on or within 20 feet of the property line. Adequate lighting should be provided over approach areas and up to the building face at all points to enable guards to see clearly all persons who approach the building. Type A luminaires installed on pipe brackets located on the building face are usually used in this case, and Type B luminaires may also be used where mounting heights of 30 to 40 feet are available.

"Water front" boundaries present a special problem when there are navigable channels, and any system selected should have the approval of Coast Guard officials. Wide light projection out over the water is desirable, to aid in detection of stealthy approach of intruders. Either Type A or Type B luminaires are applicable for lighting water front boundaries, but should be located so that no shadowed areas from embankment or uneven terrain exists, and more light should be provided than for fenced boundaries.

Entrances. Two classifications are desirable for entrances, from a lighting standpoint: active and inactive. Active entrances are considered as those that are attended and authorized for use at night. These are permanently lighted. Inactive entrances are provided with identical lighting layouts, but are provided with auxiliary switching so that the lights are operated only when the entrance is in use.

Two luminaires are recommended for use at all entrances, for purposes of reliability. Type A units installed 20 to 25 feet high, one at or inside the gate and one diagonally across the driveway and outside the gate, make identification of personnel easy and meets all requirements for pedestrian entrances. Similar recommendations apply for conveyance, or conveyance and pedestrian entrances, except that spacing will be determined by the maximum length of vehicle to be inspected, and mounting heights should not exceed 20 to 25 feet. Where construction of guard's quarters permits, use of a 100-watt Type D unit recessed in the face of the building over the doorway is also desirable.

Roadways in plant. Roadways within industrial properties, either in open areas or in close proximity to buildings and structures are normally lighted with Type A units, following the usual good practice recommended for street or highway lighting. Floodlights, or Type B units, can also be used for roadways adjacent to buildings which afford 30 to 40 foot mounting heights. Where roadways are alongside buildings, Type A units can be mounted on brackets on the building walls. In general, a spacing ratio of six to ten between spacing of units and mounting height gives good practical results, using 300-watt lamps. Where units are installed over the roadway, symmetrical or two-way parallel lobes units are recommended. Where units are installed to one side of the roadway, medium or wide asymmetric units are recommended.

Yards, Storage Areas. Type B units are generally preferable for lighting open yard areas and outdoor storage spaces. A low level of diffuse illumination is adequate for protective lighting in these areas. Units should be located so that they provide a good distribution of light in aisles, passageways and recesses, and eliminate all shadows. In open yards, units can usually be installed in groups on poles or towers 50 to 75 feet high, located in the center of the areas. Storage spaces usually restrict pole locations to border areas, and pole heights of 30 to 50 feet are adequate to minimize shadows from material stacks.

Wiring Circuits

Maximum protection measures should be incorporated in the electrical wiring circuits for power for protective lighting. Underground distribution systems, with the necessary wiring above ground carried in conduits or inside the poles, are preferred. If overhead lines are used, they should be placed as high as possible and should not be accessible from pole steps or fence tops. Control equipment may be actuated by pushbuttons, time switches, or photoelectric relays, but auxiliary manual controls should also be provided. Either series or multiple distribution circuits, whichever are most advantageous from an operational and economics viewpoint, may be used.

Acknowledgements. This roundup of protective lighting techniques is based on ASA A85-1942 American War Standard for "Protective Lighting for Industrial Properties", recent studies of the IES Committee on Protective Lighting, and on latest pamphlets and information furnished by several manufacturers of protective lighting equipment. Information, illustrations and drawings were furnished by the following: Benjamin Elec. Mfg. Co., Crouse Hinds Co., General Electric Co., Holophane Co., Inc., Illuminating Engineering Society, Line Material Co., and Westinghouse Electric Corp.

LIGHTING MAINTENANCE is available in many localities by specialized service organizations, trained and equipped to do the job expertly and economically on short notice, and usually around the clock.

Lighting Systems Maintenance—Part II

Case histories of lighting maintenance programs and discussion of maintenance costs.

By J. C. Forbes

Supervisory Engineer
Lamp Department
General Electric Company
New York City

THE objectives of lighting maintenance, including cleaning, lamp replacement and repair techniques and costs, were discussed in Part I of this article. Further discussion of costs, including case histories of existing lighting maintenance programs, are given below.

In one large installation the maintenance engineer was able to correlate relamping, cleaning and repairs, and to work out a maintenance plan ahead of time and to sell the idea of the economies involved to the management. In this installation there are 9000 units of the two- and three-lamp 40-watt types involved. These units are mounted 16 feet above the floor. The plant operates 24 hours a day, six days a week.

Two 2-man crews on the third shift maintain the lighting in this installation under the supervision of a foreman. Each crew is able to service 60 units in the standard eight-hour period, so that 120 lighting units are maintained daily. These two crews each work six days a week, thereby maintaining 720 lighting units per week. It thus requires 13 weeks to complete a cycle of the plant, permitting four services each year.

Some time ago the practice of dating lamps as they are installed was started. As a result lamps with many different installation dates can be found in any section of the plant at any one time. The maintenance crews follow the practice of replacing lamps that are nine months old by inspecting lamps while the fixtures are being cleaned.

Illumination levels in this plant vary between 35 and 45 footcandles. The 35 footcandle value is a minimum. These people know that if they did not clean the lighting equipment on such a schedule, and if they left all lamps in to burn out and then relamped them individually, the top illumination level would not exceed 25 footcandles. In other words, by the expenditure of a few maintenance dollars on a cleaning crew, and a few extra dollars on lamps, they are getting better than a 50% bonus from their lighting installation. These additional maintenance costs are only a small percentage of the overall lighting cost.

In another plant the fluorescent lighting system consists of 10,000 units of the two-lamp 85-watt type. These units are installed 18 feet from the floor. The plant operates three shifts, five days a week, for a total of 120 hours weekly, or approximately 6200 hours a year. Three 3-man crews maintain this lighting system, with one crew on each of the three shifts per day. Each crew cleans approximately 45 units daily, so that a total of 135 units are maintained in a 24-hour day. It takes 75 days for the three crews to complete the cycle around the plant, or a total of 15 weeks.

The schedule in this plant includes cleaning and relamping every time the crew goes around. Under this plan lamps are operated only 1800 hours before they are discarded. With improved life and maintenance performance of current production lamps, the lamp replacement schedule could be extended without losing any of the benefits of the overall maintenance program. The average intensity runs 35 footcandles, and does not drop below 30. But without maintenance

CHART E—Cost Comparisons of Maintenance Programs

Applied to Same Lighting Installation (a)

Cost Factors	TYPE OF MAINTENANCE PROGRAM: No Maintenance (b) 85-watt	No Maintenance (b) 40-watt	All Units Maintained (c) 85-watt	All Units Maintained (c) 40-watt
Lamps (d)	$ 3,400	$ 400	$ 4,533	$ 533
Power (e)	13,736	1,900	13,736	1,900
Labor (f)	510	150	2,040	600
Total	$17,646	$2,450	$20,309	$3,033
Total Cost	$20,096		$23,342	
Footcandles	30 (g)		45	

(a) Details of installation: 1700 2/85-watt luminaires—3400 lamps and 500 2/40-watt luminaires—1000 lamps; operates 80 hours per week for 50 weeks a year—4000 hrs.
(b) All fixtures operate—use approx. equivalent of 1 lamp per year in all fixtures.
(c) Relamp at 80% of expected life—Use 1-1/3 lamps per year in all fixtures.
(d) 85 watt lamps @ $2.00 ea. net, including tax; 40 watt lamps @ $.80 ea. net, including tax.
(e) Cost of power used for lighting for 50 weeks—$15,636.
Total kilowatt hours used—1,564,000 @ $.01 per kwh.
(f) Cost per lamp for relamping only—$.30; cost per lamp for relamping and washing two times per year—$.60.
(g) Illumination intensities are 30-35% below design service values.

CHART F—Light Depreciation Due to Lamp Failure

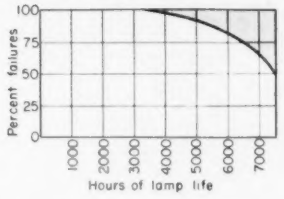
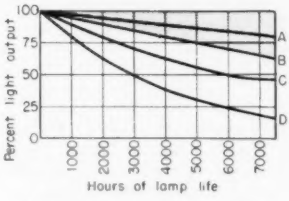


CHART G—Light Depreciation Due to Dust and Dirt Accumulation



A—Depreciation at 1% per month
B—Depreciation at 2% per month
C—Depreciation at 4% per month
D—Depreciation at 8% per month

the footcandles would never exceed 25. On this installation the 3-man crew seldom operates as a complete unit. Two men always work together. The third man very often is able to do his job of supplying new lamps and removing the old ones in quick time which leaves him time to take care of urgent requests from executive offices and a few critical locations where a burnout cannot be tolerated even for a short period.

It can be argued that the two case histories presented above are both large installations, in plants which have maintenance crews already established to maintain various mechanical and electrical devices used within the plant. The point has already been made that lighting maintenance can be applied to an individual fixture. In large installations lack of lighting maintenance is usually the result of insufficient manpower, or of funds available to the maintenance department, or of lack of proper information on the basic needs for lighting maintenance on the part of the plant management. In small installations lack of lighting maintenance is usually the result of not having proper information on the basic needs.

Solution to this problem in most cases is probably an economic analysis, in which some light measurements throughout the plant, necessary cost figures, study of how often the fixtures should be cleaned and how often relamping should occur, are used to prove whether better maintenance can be justified. There are many people in the lighting industry ready and willing to help any individual plant engineer with such an analysis and study.

The question of whether lighting maintenance should be done by the plant maintenance department or by an outside specialized lighting maintenance service company will have to be determined on an individual basis for each plant. In general, it will usually be less expensive if the plant's own employees do its own lighting maintenance. However, the important thing is to get the job well done and have the cost determined objectively, free from in-plant problems of charging service costs. For this reason, it may be more advisable to call in the outside company to do the job. In small shops and plants it certainly seems advisable to contract for lighting maintenance, because that eliminates the need for having any additional employees on the payroll even temporarily.

Chart E shows cost comparisons between two types of operation applied to a specific lighting installation. In one case, lighting costs are based on "no maintenance". The second case considers adequate maintenance of all units.

The trend in lighting is generally toward higher levels of illumination to reduce eyestrain, and to aid in making a better quality product. Most plant engineers feel that they need all the light they can get. For these reasons, it is suggested that plant engineers make a thorough study of their lighting systems to determine if their present system is producing what it was expected to do when originally installed. If, with the expenditure of an additional 15% of present light bills, the lighting can be increased by 40% to 50%, it seems much more sensible to do this than to go through a costly and time-consuming job of redesigning the existing lighting system unless the level of lighting produced thereby is still below that which should be provided for the kind of work being done in the shop.

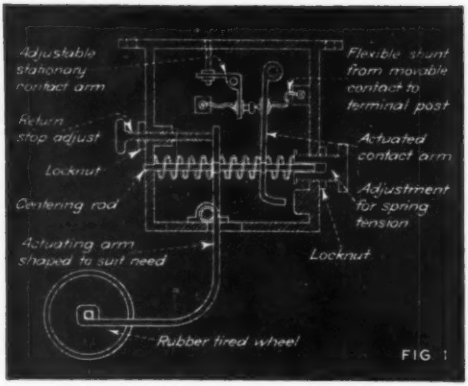


FIG 1

Remote Control Circuit Safety

Continuing the series on precautions which should be observed in the application of automatic devices to industrial control circuits.

By Thomas R. Hughes

THIS article is written for the electrical contractor, plant engineer, or maintenance electrician and not for the apparatus design engineer who works daily with such problems. Our purpose is merely to point out some fundamental precautions to be observed in the use of automatic control devices for triggering industrial control circuits. In general, such devices consist of limit switches, pressure switches, float switches, thermostats, photoelectric relay circuits, and a host of variations or combinations of such units.

However, before going into the use of these devices, we must start with the correct applications of the primary equipment whose function they are to control. In almost all cases they will govern the primary equipment by means of a solenoid actuated contactor. Failure of the main contactor or controller, as may happen with misuse in handling large loads, will make any devices in the remote control circuit impotent.

As an example: frequent cross-the-line starting of a large motor (20 hp. or larger) for jogging or inching a conveyor, pressing ram, or a positioning mechanism, is not only poor engineering but deals out severe punishment to the normal air-immersed controller. Such a motor could be connected through a magnetic, pneumatic, or fluid clutch so that it could run continuously; or hydraulic pistons or rams could be used in pressing and elevating applications so that a small motor could run continuously to furnish the hydraulic storage of power. If such substitutions are not possible and the large motor must be started frequently, then one must forget simple cross-the-line start motors and resort to wound-rotor or other proven solutions.

Frequent make-and-break of heavy amperage loads by ordinary air-immersed contacts will ultimately produce molten burrs of copper on their faces. On cooling, such a burr may freeze the contactor in the closed or running position and this makes any safety device in its control circuit useless.

Control Application

The same applies to control of large heating loads. In a large furnace, where a close range of control is necessary, the control circuit should be handling only a portion of the heat elements while the rest operate continuously. But, of course, all this is just elementary engineering and we merely hint at it to show the proper place to start.

Aside from sorting, rejecting, ejecting, and other such continuous operations, the automatic control devices we named are normally used to control limits of operation. And, if safety lies within those limits and destruction lies beyond, we had better learn what we are letting ourselves in for. If the destruction may be serious we had better provide an additional device as a secondary line of defense; and if the destruction can reach tragic proportions we should entirely remove our secondary defense from the circuit.

If, for instance, a power failure or short circuit could void the functioning of our control circuit in preventing destruction, then we should provide a secondary defense that is air actuated or depends on weights, springs, or hydraulic pressure. Here again, the possibilities cover a vast field and we merely hint at the need and leave solutions to the reader.

Taking up the first device we named, the limit switch: we can choose from many varieties manufactured as stock items. If we don't find one to satisfy our needs we can probably convert one or order a special. Figure No. 1 illustrates the simplest type of limit switch with details of its working parts. The activating arm and springs can be balanced up for various mounting positions.

A simpler model of the same type which eliminates the adjusting possibilities, is used for hoists and cranes. It depends on a weight to hold the contacts closed. The weight is suspended by a chain or bell cable at the upper safe limit of travel and, as the load hook raises the weight, the contacts are opened and drop out the controller to stop the hoist.

Since the switch is to control limits of movement, we must take into account the speed the equipment travels, the precision of control required, and other such items. The two most simple examples are the crane hoist and the conveyor shown in Fig. No. 2. In either case the switch must be placed for sure stopping of equipment before damage can occur.

Use of Solenoids

It will often be necessary to use a solenoid brake or other such mechanism to overcome the momentum of the machinery concerned. In dangerous machines such as rubber calenders, a manual emergency shutoff is provided, handy to the operator. This not only

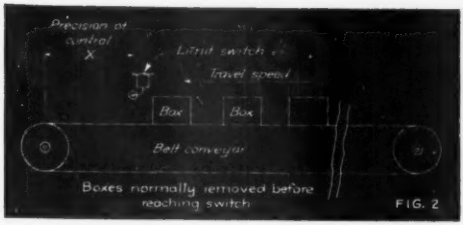


FIG. 2

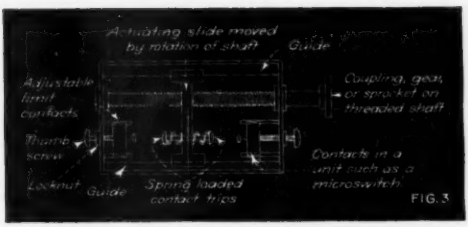


FIG. 3

opens the controller for the large drive motor but applies electrodynamic braking to it for stopping the turning of the rolls in the fewest inches possible. If it is a slip-ring motor with resistance loaded secondary, it may be plugged (stator leads reversed, with resistance in secondary) for a quick stop.

A limit switch should always be wired to operate in a normally closed or energized circuit if possible. For such applications as hoists or conveyors this presents no difficulty but in a reversing set-up, as illustrated by Fig. 4, this may not be possible. The actuating slide in the mechanism of Fig. No. 3 may activiate a group of contacts that drop out the raising controller and start a timer that eventually closes another controller for reversing the motor and lowering the car to the loading position.

Limit Switches

Also, where possible, the activated member of a limit switch should be applied directly to the load or material being handled. This is illustrated in Fig. No. 2, where the boxes on the conveyor will trip the actuating arm if they are not removed before reaching it. The suspended weight on a crane is usually hollow and circumscribes a hoist cable so that it is raised by direct contact with the load or traveling block. In Fig. No. 4, however, one sees that there is no direct connection between the load and the limit switch, which is mounted on the end of the hoisting drum shaft.

When the load directly actuates the switch, the mechanism must be arranged to allow ample divergence of movement within its parts. In the designs of Figs. 1 and 3, this tolerance is provided by spring compression. On the crane hoist, it is provided by slacking in the chain or cable suspending the weight. In other cases it could be attained by friction slippage or weight balance.

Fig. No. 4 shows a case where the limit switch must span two distant but precise limits of travel. Fig. No. 3

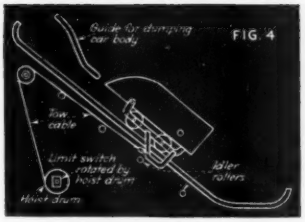


FIG. 4

shows how this is arrived at by the rotation of the threaded shaft, moving the actuating slide one thread for each turn of the shaft. Thus, a large number of turns can be accomplished between the two end limits and they are adjustable for the correct point of shutoff.

Such a mechanism may be driven by gears or chain and sprockets. The reader doesn't have to be told that prevention of failure depends on adequate mechanical maintenance of these components. Foolproof keying of parts to shafts and preventing failure from wear.

Often a limiting mechanism will be thrown completely off in its operation if the motor is connected with wrong rotation. Some of the small electric hoists, for example, are controlled up or down by two ropes hung from opposite end of a rocker arm. As the load hook reaches the upper safe limit of travel it engages a mechanical linkage that forcefully restores the rocker arm to the off position. There have been cases of certain hoists breaking parts or stripping gears while the operator stood helpless because this linkage was so designed that wrong rotation causes it to hold the rocker arm in the raised position rather than throwing it to the off position.

The next device we listed, the pressure switch: may be activated by most any fluid in a hot or cold condition. In many cases it will be necessary to isolate it from the fluid by a preceding diaphragm and an isolating fluid such as mercury, oil, or an inert gas. This may be because of the explosion hazard presented by accidental release of combustible gas or vapor into the electric wiring of panels, or it may be because of corrosion or other deteriorating effects.

A pressure switch often requires some means of damping pressure reaction in lines, such as an orifice or a pig-tail in the tubing which feeds pressure to it. In some cases, where it controls a solenoid valve, there may be considerable hydraulic impact or "hammer" applied to it. On the other hand, if it controls a large pump feeding into a hydro-pneumatic pressure tank, a resonating surge can develop in the line at shutoff which will cause the pressure switch to alternately stop and restart the motor on recurring intervals of seconds duration, till the controller freezes in the running position or the overcurrent relay trips.

To avoid the chance of any such happening, a pressure gage should always be inserted in the pressure tubing at the pressure switch, if a liquid is being handled in the pipes. Any surges in the line, after shutoff, will be indicated by the gage hand. The tubing can be coiled into a pigtail or a small orifice inserted—always on the line side of the pressure gage tee connection.

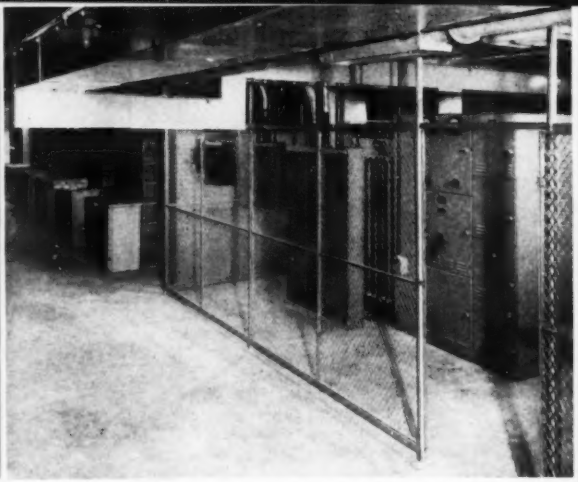
Relief Valves

Of course, the only secondary defense for a limit switch is another limit device. A pressure switch may be augmented by another pressure switch fed through a separate gage pipe, so that stoppage of the damping orifice could not cause disaster. However, there should always be a pressure relief valve or valves, of adequate capacity, on any sizable pressure vessel connected to the line.

Float switches are fairly simple and fool-proof but they should always be arranged to open the circuit if the float falls off; assuming, of course, that continuous operation would be detrimental and that there is no attendant near to notice the continued operation. Since the normal float switch will be wired to open the circuit at the upper

[*Continued on page* 138]

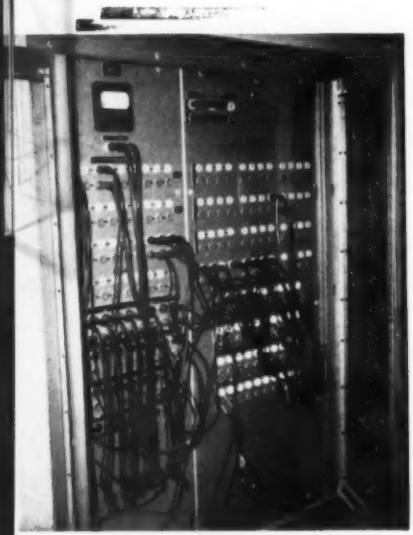
DENTAL CLINIC is cove-lighted for general illumination although local light sources are provided for critical work.



LOAD CENTERS are dead-front, self-contained, metal-enclosed and Askerel-cooled; located in central basement corridors.

WIRING A Medical School

University of Washington's new medical, dental and nursing school—wired by the Industrial Electric Company of Seattle—ranks as one of the nation's top electrically-equipped educational and clinical centers.



DIRECT CURRENT for experimental, operating and laboratory use, available through wide range of voltages, is provided through cord-jack master control panel located on ground floor.

By Howard E. Bayley
Industrial Electric Company
Seattle, Washington

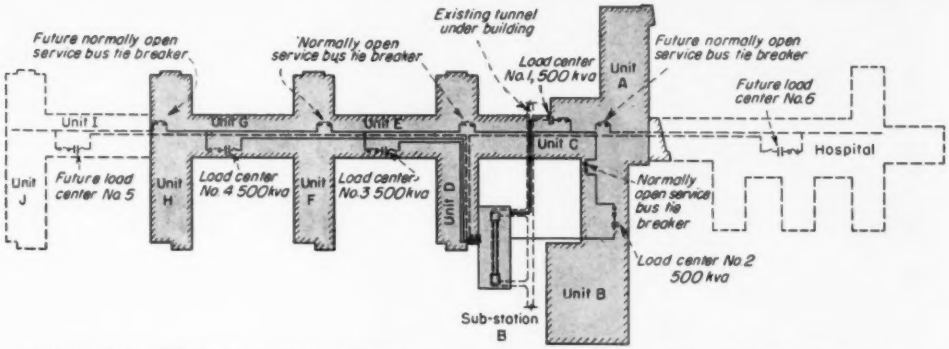
PRIMARY electric distribuation at 2300 volts, load-center substations, a sectionalized busduct system, and numerous remote controls serve one of the most modern college medical centers in the country—that of the University of Washington in Seattle. When completed, this 1200-foot-long Health Sciences Building will consist of eleven 4-floor connected structural units, serviced through six 1300-120/208-volt load centers. Seven units already are completed and occupied, with four load centers now in operation.

Due to the comprehensive requirements of medical, nursing and dental departments, special areas include auditoriums, clinical laboratories, projection and lecture rooms, surgery theatres equipped to televise operations, photographic studios and dark rooms, X-ray facilities, shops, a museum, library and offices. Listed on the load-building charts are such items as electric ranges, unit heaters and coolers, portable X-ray equipment, water stills, incubators, fans, vacuum pumps, dish washers and freezers, sanders, saws and drill presses, lathes, elevators, fume hood exhausts, filter drives and heating pumps.

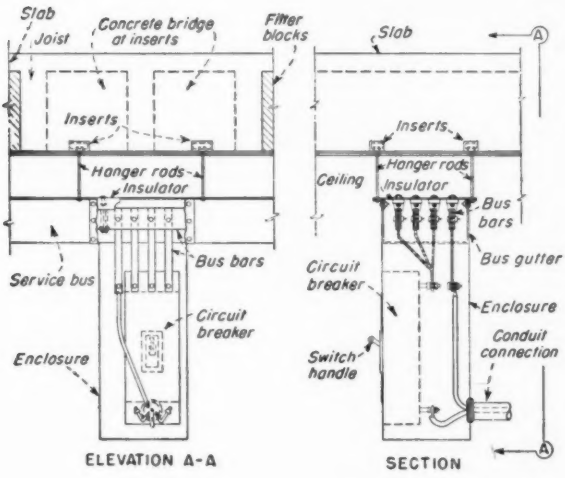
This adds up to interesting distribution, ventilation, lighting, grounding, paging and public address installations by the Industrial Electric Company, electrical-contractors of Seattle.

Primary distribution, from one of the University's 13/2.3-kv substations to individual load centers, is underground through radial runs of 3/c VCLC cable. Load centers are dead-front, self-contained, metal-enclosed and Askarel-cooled, each including an incoming line section, 2300-v primary switch, 2300 to 120/208-volt transformer and series of draw-out 4PSN air circuit breakers.

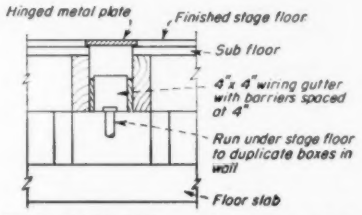
Each load center feeds a section of 4-wire 1000-amp enclosed busway; sections varying in length from 150- to 350-feet. Sections are interconnected through normally-open bus tie breakers which may be closed manually to provide temporary power from adjacent bus sections in the event of an



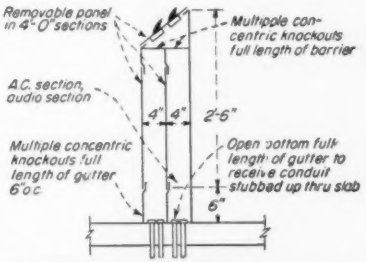
SINGLE LINE DIAGRAM of substation, load centers and enclosed busbar network indicates provisions for cross connections to insure service continuity throughout the entire medical school unit.



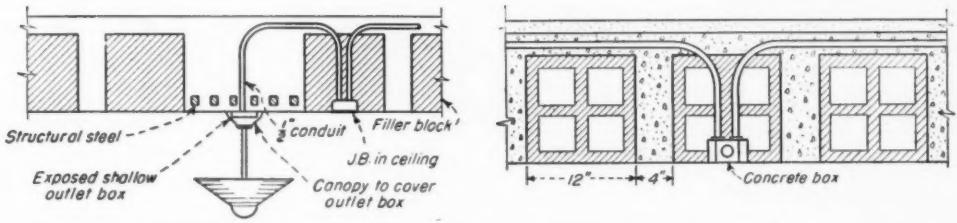
PANEL FEEDER CIRCUIT BREAKER connections to service bus are through 4-pole solid-neutral manually-operated switch units suspended beneath metal-enclosed bus gutters.



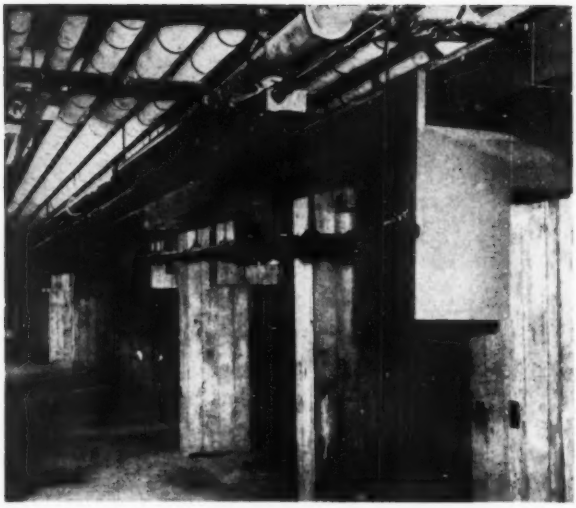
STAGE FLOOR BOX consists of a 4-by-4-inch wiring gutter recessed beneath a hinged metal cover.



THEATRE CONTROL WIRING is carried in special wiring gutter installed for full width of projection booth.



FLOOR SLAB CONSTRUCTION, using pre-cast filler blocks between reinforced concrete beams and joists, carries circuit conduit in top; outlet and junction boxes in bottom, as indicated.



ENCLOSED BUSWAY is sectionalized, with normally-open manually-operated tie breakers connecting individual segments. Feeder breakers—connecting cable risers to bus runs—are 4-pole solid-neutral units.

individual load center failure.

Local distribution panel feeders are dropped vertically from upper-floor control points to the basement level where they are connected to the main bus distribution system through manual air breakers. Breakers interrupt only phase legs, with neutral connections remaining unbroken.

Floor Slab Wiring

An unusual concrete floor construction (combining pre-cast filler blocks with a poured joist-and-slab installation) resulted in a branch-circuit arrangement whereby conduit is carried in the poured upper sections of the slab, bending downward to junction boxes recessed into filler blocks. Where lighting fixture outlets are positioned on beam centers, junction boxes are located in adjacent filler blocks, with connecting conduit sections arching upwards to the slab elevation from the two boxes. Use of filler blocks lessened construction costs, resulted in less cutting and easier access.

Many power control panels are equipped with tell-tale indicating lights, remotely notifying watchmen of areas in the building where circuits are in use.

Dc, with a wide range of voltages, is supplied through a ground-floor distribution center. It is available for experimental work in general, physics and research laboratories, lecture and operating rooms, storage areas and hot, cold or controlled-temperature rooms. The distribution board is served by two sets of wet batteries, housed in vaults adjacent to the board, and serviced by trickle chargers.

The grounding net consists of series of ¾-inch ground rods interconnected through 1/0 wire.

Occupying the second and third floors of the entrance wing is a 550-seat auditorium, electrically equipped to rank with the best in the country. Two motion-picture machines, two slide projectors, a public address system with controlled amplification, motorized stage curtains and roll-down screen, three turntables for transcription broadcasts and several microphones for lecture use are controlled from either of two control panels in the modern projection booth at the upper rear of the auditorium. Stage footlights, both white and colored border lights, and spotlights are controlled from these same two projection-booth panels plus a backstage switchboard. Auditorium house lights are controlled from these three stations, plus a fourth control center located at the main entrance. Dimmer controls on all lighting circuits and the provision for controlling lights from any one of four stations results in unusual operational flexibility.

Recessed into the stage floor, beneath a hinged metal plate, is a 4-by-4 inch wiring gutter having barriers on 4-inch centers. This multicell stage box holds outlets for microphones, telephone, volume indicator, PA amplification control, duplex receptacles, warning lights and signal circuits for backstage or projection-room synchronization of electrical performance.

The extensive wiring for projection-room control is carried in an 8-inch by 3-foot wiring gutter, located beneath the observation and projection windows, extending across the entire width of the projection room. This gutter is divided vertically to form two 4-inch-wide gutters (power and audio), while control panels are positioned on the slanting gutter top, beneath operator windows. Multiple concentric knockouts are located on 6-inch centers along the entire lower front and top gutter panels, permitting circuit and control wiring to any desired point, and the open bottom of the gutter permits conduits to be stubbed-up through the floor slab at all positions.

Controlled Lighting

Much of the lighting throughout the building is direction-controlled, with illumination above bulletin- and chalkboards directed downward and inward; lighting above operating chairs and lecture tables focussed on the central areas; reflectors behind library book-stack lamps directing beams down and outwards toward the shelves, and incandescent coves in clinic halls reflecting light upward and in towards the center ceiling.

Several of these coves combine more than a single lighting system, for in addition to containing fixtures for general illumination, some coves are faced with colored-lens signal lights (to call the attention of supervising instructors to specific dental chairs in the clinic hall), while other incandescent coves have emergency lamps positioned between the inverted show-window reflectors of the general system.

The entire Health Sciences Building was planned by Naramore, Bain, Brady, Johanson, McClelland and Jones, Associated Architects. Design of electrical and mechanical work was executed by Lincoln Bouillon and Associates, professional engineers. Electrical work was installed by the Industrial Electric Company.

Score bigger sales with this HEAVY HITTING AD CAMPAIGN

A power-packed program... exclusively for Electrical Contractors

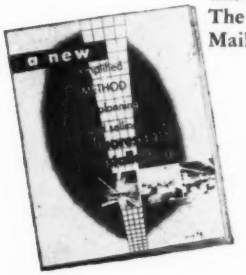
Here's a campaign that keeps on slugging and plugging for you!

It's Sylvania's complete advertising program ... especially planned for electrical contractors. Everything is included ... from national ads and the big TV show "Beat the Clock"... to personalized mailings sent out by Sylvania to your own selected lists.

QUALIFIED LIGHTING CONTRACTOR SYLVANIA SALES SERVICE

Included, with this campaign, are new colorful decals to identify your business. Also, ad mats, spot radio announcements, news stories and speeches. There's even a valuable sales manual on how to plan and sell a fluorescent lighting installation.

No wonder contractors everywhere are really enthusiastic about this great Sylvania campaign. You will be, too. The coupon brings you full details. Mail it NOW!



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SYLVANIA ELECTRIC

FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; PHOTOLAMPS; TELEVISION SETS

Practical Methods

UNDERFLOOR DUCT system of UN Secretariat Building consists of triple fiber raceways for carrying telephone, lighting, business machine and buzzer circuits.

Triple Fiberduct Serves United Nations

WIRING

To carry circuits to serve light, telephone, business machine and buzzer outlets in the United Nation's new 39-floor Secretariat Building in New York City, electrical contractors Fischbach Moore installed approximately 43 miles of General Electric Fiberduct. This underfloor distribution system takes the form of a triple-duct grid design, with factory-set inserts installed every two feet to handle the necessary outlets. Because of the system's flexibility, the addition of personnel as U N membership increases will present no electrical problem, since new outlets may be added at any time during or after construction. Additional wires can be pulled into the ducts as load requirements demand, without interfering with normal office operations.

In addition to providing a flexible wiring system, the underfloor duct system permits changes in office layout necessitated by fluctuating office activities, methods and personnel. It eliminates dangerous and unsightly extension cords, keeps walls and ceilings free of outlets, provides maximum space conservation and, by eliminating the necessity for constant re-routing of conduits, makes a positive contribution to maintenance and management.

The installation procedure was to obtain accurate levels for the finished flooring, making frequent datum marks on walls and columns for accurate reference purposes. Junction boxes were then positioned and carefully leveled to coincide with the finished floor elevations. After boxes were grouted into place, ducts were installed between boxes and accurately lined up and fixed in position for both elevation and direction. Inserts were finally leveled. Home runs between junction boxes and distribution centers were installed and, with the system so installed, the concrete floor slabs were poured, covering and permanently securing the duct system.

Surplus Wrecker Serves As Boom Truck

CONSTRUCTION

A truck originally designed as an Army C-2 aircraft wrecker is now a heavy duty all-purpose boom truck for the Collier Electric Company, Denver electrical construction firm. Collier purchased the truck from Army surplus to erect substation towers at a new Public Service Co. of Colorado generating plant; now uses it for all types of lifting chores.

The unit has a six-wheel drive (10 wheels); has a self-contained 3,000-watt, 110-volt, generator plant for floodlights and electric tools; has side and rear outriggers to stabilize the truck under heavy boom loads. A cable-pulling winch at the rear of the truck body is equipped with 500 feet of steel cable; is driven by the main motor but separately controlled at the winch position.

The boom swing and lift as well as the hoisting cable are driven by the main motor and controlled by levers just behind the truck cab. Length of boom can be varied from 30 to 60 feet by adding pre-fabricated sections. At a seven-foot radius, the small boom is rated at 10 tons, slips at 12 tons. Lighter loads are handled by the longer

STEEL TOWER SECTIONS are hoisted into position by all-purpose boom truck which was formerly an air-craft wrecker.

HEAVY TRUCK has outriggers (arrow) for stabilization under heavy boom load conditions.

"fresh air" for workers becomes more essential!

. . . as manufacturing tempo increases . . .

● New buildings, new additions and departmental changes in present buildings will be called for as the defense effort swings into "high gear". In all cases, be sure to remember *good* ventilation as a means of holding present employees and attracting new workers. It's one of the "big four" requisites for good working conditions, according to a nation-wide survey of industrial workers.

Perhaps the easiest, quickest way to provide a rapid air change system is to install direct-drive ILG Self-Cooled Motor Propeller Fans in window, wall, or penthouse (with automatic shutter). Certified ratings (NAFM label) testify to remarkable capacities. Decibel ratings vouch for extra-quiet operation. All ILG's famous features for high efficiency, economy, low maintenance, and long life are built in. These include the exclusive ILG Self-Cooled Motor, designed specifically for exhaust fan duty. And each complete ventilator, fan and motor, is covered by ILG's "One-Name-Plate" Guarantee.

The complete story is covered in bulletin 149-1. Get your copy by calling nearby Branch Office (consult classified directory), or sending coupon today.

VENTILATION

Free! Engineering data bulletin 149-1 contains all essential data — sizes, capacities, dimensions, ratings. Send coupon now.

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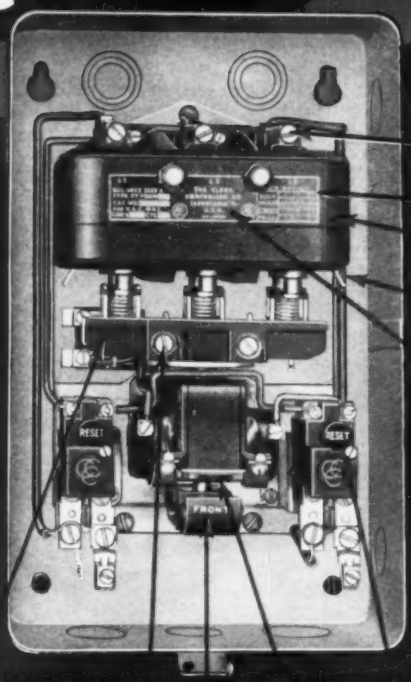
It's All New! The CLARK "CY" AC Motor Starter

The Starter



PRESSURE TYPE TERMINALS LINE AND LOAD

ONE PIECE UPPER ARC SHELL PROTECTS TERMINALS FROM HOT GASES

ARC SHIELDS OF INORGANIC NON CARBONIZING MATERIAL

FINGER CLIPS FOR EASY CONTACT INSPECTION

MAGNETIC ARC INTERRUPTERS WITH STEEL ARC CHAMBERS

CAPTIVE SCREWS IN CONTACT ARM

ONLY TWO SCREWS AND ONE PIN TO REMOVE

VERTICAL LIFT MAGNET WITH STEEL GUIDE USES NO SPRINGS

another CLARK FIRST!

Here, for the first time is a rugged AC magnetic starter that provides the extra protection and dependable operation of "Mill-Type" heavy-duty construction and design at *no premium above ordinary starter prices!*

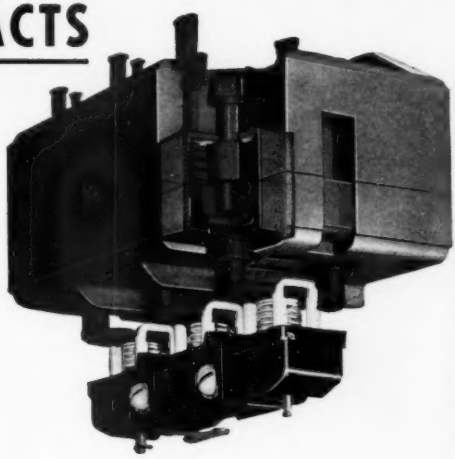
This BLUE RIBBON PRODUCT will help build your business through increased customer satisfaction.

CLARK ENGINEERED ELECTRICAL CONTROL

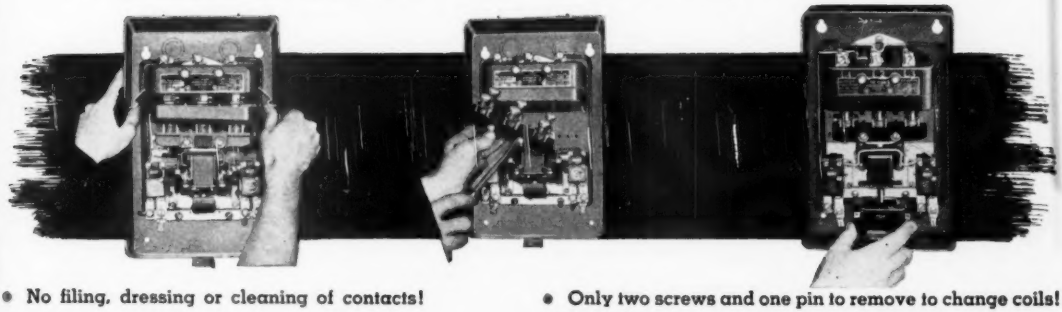
with the sensational NEW multi-turn magnetic blowouts

and TWIN-BREAK CONTACTS

The "CY" starter employs an entirely new principle of arc interruption. The arc is extinguished by the effect of the blow-out coil, *concentric with the contact.* The magnetic field quenches the arc either by lengthening or confining it. In its *forced rotation* it moves continually from a hot to a cold spot —preventing burning or pitting of contacts. The ingenious design of the arc chamber prevents carbonization and the accumulation of ionized gases between wiring terminals —minimizing phase-to-phase failures.*



The Maintenance Man's Dream!



- No filing, dressing or cleaning of contacts!
- No tools necessary to inspect contacts!
- Easy to change moving contacts!
- Stationary contacts changed quickly with screw driver!
- Only two screws and one pin to remove to change coils!
- Only four screws to remove to take out stationary magnet frame!
- Power circuit contacts available with springs in complete packaged service kits for ease in stocking!

**Magnetic blow-out coils are used on all size 2 and 3 "CY" starters. Sizes 0 and 1 use the same general Mill-Type construction as the larger sizes.*

THE CLARK CONTROLLER CO.

1142 EAST 152ND STREET · CLEVELAND 10, OHIO

R&S

LIGHTING FIXTURES

EXPLOSION-PROOF

CLASS I, GROUPS C & D

Wherever flammable materials are manufactured or used by industry, the complete line of R&S explosion-proof lighting fixtures is specified for the extra margin of safety and protection provided personnel and equipment in hazardous locations. There's an R&S fixture for every need . . . in pendant, ceiling, bracket or hand types . . . from 100 watt through 500 watt sizes. Standard conduit bases permit interchangeability of reflector globe assemblies.

WRITE FOR CATALOG NO. H-47

Ceiling Type with Guard — without Reflector

Pendant Type with Guard and Dome Reflector

Bracket Type with Guard — without Reflector

Pendant Type without Reflector

With Angle Reflector

With Standard Dome Reflector

Bracket Type without Reflector

VAPORTIGHT

The complete line of R&S Vaportight Lighting Fixtures offers maximum indoor and outdoor protection against non-inflammable gases, vapors, dusts and moisture. The fixtures are available in a wide range of ceiling, pendant and bracket types—in 15 watt through 500 watt sizes. Bases have wiring chambers that stay vaportight in service when globes are removed or broken. R & S outstanding vaportight qualities combined with superior illumination keep this fixture line out in front in fast-selling popularity and industry-wide acceptance.

WRITE FOR CATALOG NO. P048-4

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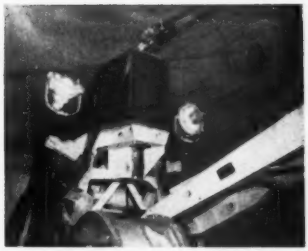
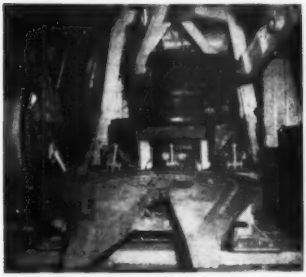
RUSSELL & STOLL



EXTENSION OF BOOM CABLE support by 2½ feet added vertical lift to boom for high elevation work. Box frame was added to existing pulley base.



DOLLY ARRANGEMENT was added to the base of the boom. Heavy steel plate table now supports total weight of boom and load.

boom. Normally, a 70-foot pole can be set with the 30-foot boom.

Two minor changes were made on the boom mechanism to adapt it to Collier's needs. First, to accommodate the heavy loads, a dolly arrangement with heavy casters was added to the base of the boom. This dolly rides and rotates on a heavy steel plate "table" added to the truck bed. To gain additional lifting height, Collier engineers raised the boom cable support 2½ feet by adding a steel plate and angle-iron box frame to the original pulley base. The truck floodlights were positioned accordingly.

Compared to former rental of equipment, Collier's investment in this truck was more than returned on the first few jobs. And they are now in a position to handle heavier construction work without depending upon the services of others for specific hoisting chores.

Temporary Service For Power Tools

CONSTRUCTION

The use of power tools on any electrical construction project requires a source of energy. Frequently such energy must be supplied from a temporary arrangement until permanent

TEMPORARY POWER POLE provides 100-ampere service to groups of houses during construction of large southern California project. Grounded receptacle circuits for single-phase 110 and 220-volt power tools are protected by circuit-breaker load center.

service is installed in the building or on the project site. Many contractors use portable gasoline-driven generator sets to take advantage of power tools at the beginning of a project; others struggle along with hand tools until either a temporary or permanent line is installed.

At the vast Lakewood Park housing development (17,000 single-family houses) in southern California, Kuster-Wetzel Electric Co. (Long Beach), electrical contractors on the project, beat the gun by using 46 generator units until utility lines were extended. Once the lines were on the project site, K-W engineers designed and installed 300 temporary service poles throughout the location.

Each service pole consisted of a heavy plywood panel mounted to a stout wood timber set in the ground. On each panel were mounted a socket-type meter, 100-ampere main disconnect switch with driven-ground connection, 8-circuit load center (circuit-breaker type), and seven heavy-duty, grounded receptacles. Each pole served a group of ten houses; provided power for all trades on the project.

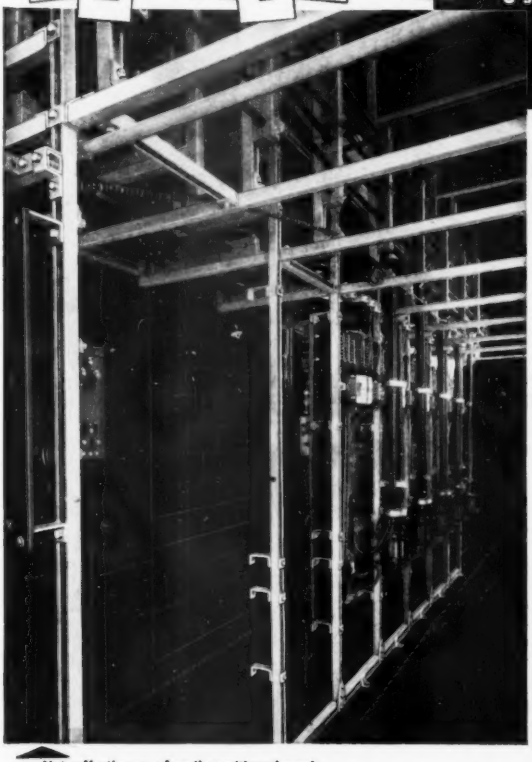
Four receptacles were of 20-ampere (110-volt, single-phase) capacity; two (painted green) were of 35 and 50-ampere capacity respectively; one (painted red) was for 220-volt, single-phase power. All were of the three-prong, twist-lock type with the third prong a ground connection. To each of the heavy-duty receptacles (green) were connected an 100-foot, 3-conductor extension with a pigtail socket every 30 feet.

When the need for power tools no longer existed in a group of houses, the temporary service pole was removed and set up at another location.

FLEXIBLE UNISTRUT

used in AMERICAN SUGAR REFINING COMPANY PLANT

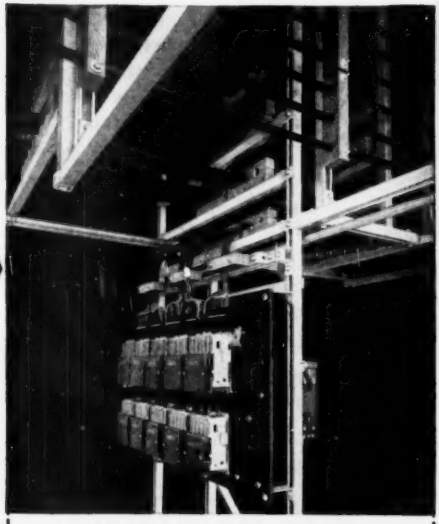
All Cable, Switchboards and Timer Control Panels Supported by Completely Adjustable Unistrut Framework



Note effective use of easily positioned maple cable clamps mounted on Unistrut channel.

These pictures show how Unistrut channel and fittings, with maple and porcelain insulators, combine to support all control equipment for the motors that operate centrifuges in one step of the sugar refining process at the Chalmette, Louisiana plant of the American Sugar Refining Company.

Unistrut permitted fast, on-the-job framing assembly where all adjustments were quickly made by merely loosening a bolt, and where supporting members were added as the work progressed. Because no drilling, welding, special tools or equipment are required to assemble Unistrut, engineering detailing and construction time were kept to a minimum. Another advantage lies in Unistrut's built-in flexibility which makes possible later changes and additions to the existing structure.



Installation is equipped throughout with Unistrut for the support of all motor control apparatus and cable.

With Unistrut you can build all types of framing, mounts, shelving, racks, tables and benches—conduit, cable, pipe and tubing hangers and supports, fluorescent fixture supports, and many other structures with just a hacksaw and a wrench. Give Unistrut a trial in your business.

FREE CATALOG and WALL CHART!

Write for your copy of 24-page Construction Catalog No. 500, 24 x 36 Wall Chart and sample of Unistrut.

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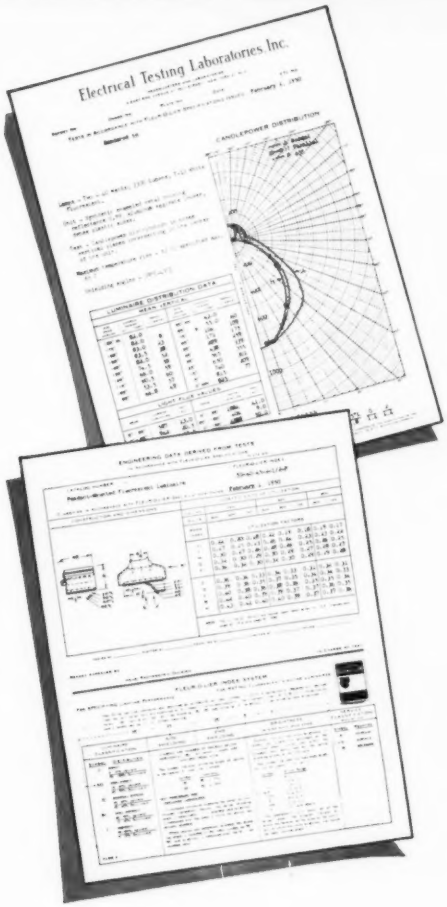


FLEUR-O-LIER DATA SHEETS give complete information

Manufacturers of Fleur-O-Lier fixtures provide Standard Data Sheets which give complete and detailed information on each Fleur-O-Lier fixture. Here, brought together on one sheet, is everything you need to know about the fixture—shielding—brightness—light distribution data—utilization factors—and construction and dimension details.

With more than 300 Fleur-O-Lier fixtures available from 25 different manufacturers—you have a wide selection of units to meet the needs of any installation.

How the Fleur-O-Lier System Enables You to Specify and Select the Right Units

The Fleur-O-Lier Index System makes the specification and selection of lighting fixtures extremely simple. Merely ask the specification writer to express the desired illumination characteristics in the simple formulas of the Fleur-O-Lier Index System.

Then the selection of lighting equipment that fits exactly the requirements of the installation is easy. Choose from fixtures that have the requested Fleur-O-Lier Index System formula and you know you'll get the desired lighting results.

Don't take chances . . . specify Fleur-O-Lier and *know* what you're getting!

Free Booklet

Write for your free copy of the new booklet giving complete details of the Fleur-O-Lier Index System.

Ask also for Electrical Testing Laboratories' report on performance ratings assigned to the 300 Fleur-O-Lier fixtures.

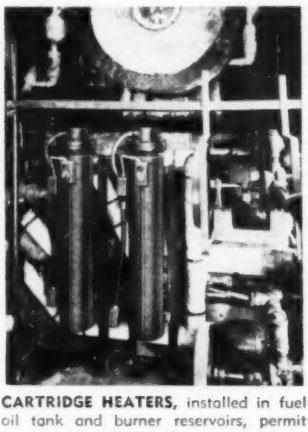
Electric Preheating

MANAGEMENT

Electric cartridge heaters are making it possible for the Polk Sanitary Milk Company of Indianapolis to heat their plant with heavier and cheaper fuel oil than that formerly consumed by their burners.

As initially designed, the burners required light fuel oil which could be readily pumped at ordinary temperatures. Heavier grades of oil would have saved money and furnished more heat units per gallon but would not flow freely without preheating. By installing Chromalox cartridge heaters in the storage tank and burner reservoirs, heavy Bunker C oil now flows freely and is used with economical results.

One of two 10 kw. circulation heaters shown in the photo operates 24 hours a day, seven days a week, at the oil storage tank which feeds two 225-



CARTRIDGE HEATERS, installed in fuel oil tank and burner reservoirs, permit heavy Bunker C oil to flow freely, effecting major dollar savings in large boiler installations.

hp. boilers. Two burners on each boiler require 55 gallons of oil per hour. Normally only one circulation heater is used to facilitate pumping and proper combustion at the burners, but when the second is needed it cuts in instantly and automatically. Pumping rate and outside temperature are factors that determine whether either or both heaters operate; built-in thermostatic control prevents under- or overheating the oil.

The reasons for choosing electric heat for preheating were its instant availability, simplicity of control, inexpensive operation and freedom from maintenance.

Economies realized through the installation of these preheaters paid for the Chromalox units within a few months of operation.

BOTH CARRY 390 AMPS.

BUT ROCKBESTOS A.V.C.® IS 43% SMALLER

With higher-rated A.V.C. and a 390 ampere load INSTALLED COSTS ARE LOWER*—

- you use a 400 MCM cable *not* 700 MCM
- you use 3″ conduit *not* 3½″
- you use *smaller* fittings and lugs
- you have *lower labor costs* because smaller, lighter cable and conduit are quicker and easier to handle.

Size for size A.V.C. has a HIGHER AMPERE RATING

Hi

. . . YOUR BEST BUY

Permanently-insulated Rockbestos A.V.C. can save you money. Write for the booklet "Cut Current Carrying Costs."

*Comparison with Type RH based on Chapter X—National Electrical Code, 40°C-104°F Ambient

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Century

Serves the Electric Motor User in Two Important Ways:

1. Century motors are designed and constructed for a long, dependable operating life.

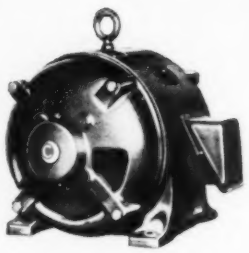
2. Just as important—they are skillfully selected to match the operating characteristics of the many kinds of equipment they drive.

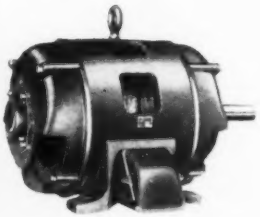
IN CENTURY'S wide range of types and sizes (up to 400 H.P.) there are available: 4 standard classes of starting torque characteristics—6 methods of speed control—constant and short time ratings—4 basic classes of frame protection against atmospheric hazards—a dozen methods of mounting the motor to the equipment—plus many special specifications to meet the requirements of the BIG NAME equipment manufacturers who use Century motors as a component part of their equipment.

Teamwork with equipment producers gives you skillfully selected motors from Century's wide range of types and sizes . . . properly applied to match the performance characteristics of the machines they drive.

Both a properly designed and constructed motor, plus skillful application, are required to give you top performance and long life on the new ultra-modern production equipment.

Specify Century motors on all your equipment.





Century 200 horsepower motor driving a hammermill used to crush feed.

Century 5 horsepower totally enclosed fan cooled motor drives a mixer in a processing plant.

Century SERVICE Is Near Any CENTURY Motor Driven Equipment

Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
2. CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.
3. Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.

709

Century Electric Company is celebrating its 50th year in the electrical industry

CENTURY ELECTRIC CO.

1806 Pine St. • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS

Motor Shops

Drill Press For Slate Boards

Drilling holes in slate or ebony boards, necessary for mounting meters or switchgear or for containing holding bolts, is facilitated in the shop of the Andren-Myerson Corporation of Boston, Massachusetts, through the use of a special drill press. Rather than mounting the press on a standard frame with limited clearance and movement, this drill is mounted on a vertical pipe column running between floor and ceiling flanged plates.

This permits the drill to be moved vertically for a distance of about 10 feet. In addition, an articulated two-section swinging arm makes it possible for the drill to be moved to any azimuth, close to the pipe column or several feet away from it. An adjustable collar around the pipe column and several locking screws permit the drill to be fixed at any desired height or position.

DRILL PRESS with double-swing arm, mounted on vertical pipe column, facilitates drilling of holes in ebony or slate switchgear boards assembled in the Andren-Myerson shop.

Slate and ebony boards are placed on a wooden frame which can be moved as desired. Holes are drilled accurately with a minimum of effort on the part of the operator.

Open-Top Cans Hold Wire Reels

A simple method for controlling the unreeling of wire used for coil winding in the shop of the Tennessee Electric Motor Service of Nashville consists of open-top galvanized-steel cans placed beneath the wire guides. Wire reels are dropped into the cans on their sides, permitting the wire to unreel as it is used and, since this position permits the wire to be drawn from any direction, the single location of reels serves several coil-winding centers.

GALVANIZED CANS, positioned beneath the framework that pays out cable to various coil-winding stations, hold wire reels. Spindles are not required and wire is pulled from the reels as needed, without allowing the wire to unwind and spring out over an unrestricted area of the shop.

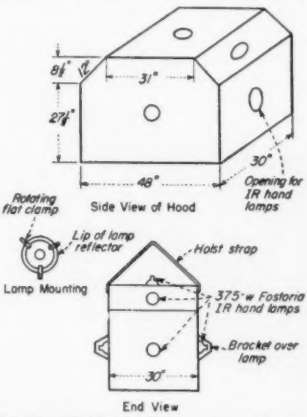
TAPE DISPENSER mounted on tool tray of winding machine at Koontz-Wagner Electric Co., South Bend, Indiana, speeds banding turns of wound coils. Unit consists of a flat-iron bracket arm slotted at one end to seat a small metal drum which takes standard rolls of Scotch paper tape. Saw-tooth clip at head of bracket cuts tape when it is pulled down over edge.

Shop Uses Infra-Red Hood

If you can't take repaired equipment to an oven, then take the oven to the equipment. That is the reasoning behind the design and construction of an infra-red drying hood at The Alliance Electric Company, motor repair shop in Alliance, Ohio.

The unit is made of sheet metal on an angle-iron frame; has a semi-octagonal cross section; is 36 inches high; 48 inches wide at the bottom and 31 inches at the top; is 30 inches deep. An inverted-V strap across the top of the hood (at 30-inch depth) forms a hoist lifting bracket for raising and lowering the unit over the work.

Hand type Fostoria 375-watt infra-red lamps provide the heating medium. A total of seven lamps are used—one in each of the panels comprising the hood (sides, ends, top and diagonals). Lamps are mounted to the exterior of the hood with three bar-clamps securely holding the lip of the reflectors to the hood panels. Each lamp can be quickly removed by simply retracting three screws. A flat-iron guard over the neck of each reflector protects it against damage.



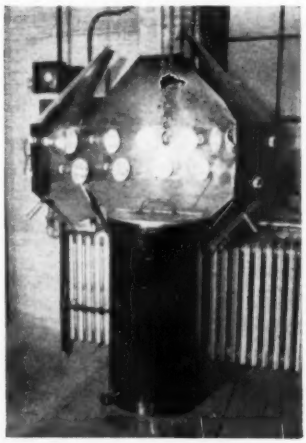
DIMENSIONAL DATA on infra-red drying hood which uses hand-type lamps. Unit can be used in shop or field.

Each lamp is individually controlled; has a flexible cord extension with a two-prong cap which connects to receptacles mounted on the side of the hood. A heavy two-wire extension cord from the hood outlets can be connected to convenience outlets in the shop or field.

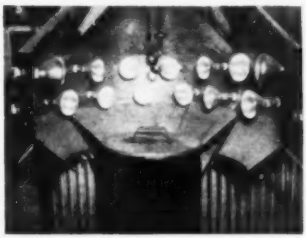
Dip Tank Has Bake Hood

Finishing time—dipping and baking—on motors up to 10 hp. size has been reduced about two-thirds at V. M. Nussbaum & Company, motor repair specialists in Ft. Wayne, Indiana. Basic reason for this was the construction of a combination dip-bake unit patterned after a design originated by Frank Willey of Cincinnati and the National Industrial Service Association research department. Nussbaum mechanics can now preheat, dip, drain and bake a motor stator or armature without removing it from the piece of equipment.

The base of the unit is a cylindrical dip tank 20 inches in diameter and 40 inches high. This is welded to a 32-inch square base made of ¼-inch steel plate. Inside the tank at the half-



DIP-BAKE combination unit confines three operations (pre-heat, dip and bake) to a single unit of equipment; is clean; cuts finishing time on medium size motor repairs by two-thirds.



LAMP RING in hood over dip tank contains two rows of infra-red lamps manually and automatically controlled. Top row is for pre-heat; bottom row for bake. Both rows can be used at same time if desired. Hinged hood sections close for baking.

Will your sales double

IN THE NEXT TEN YEARS?

There is sound reason for predicting that you *can* double your sales... or more... in the electrical construction, installation and maintenance market – if you take an aggressive part in the industry-wide drive to open up new frontiers in the 50's.

The use of electricity has doubled every decade in the past half-century, and now still bigger expansion lies ahead. The needs are urgent...

> 90% of America's homes are inadequately wired. Thousands of commercial buildings are obsolete electrically. Industry must re-equip, modernize and expand its electrical installations to handle the guns-and-butter production job ahead. New developments are opening untouched markets.

Now your company can play an important part in meeting these needs. And your products can fill an important place in the newest applications of light, power and heat.

The place to begin is the great 300 page New Frontiers issue of Electrical Construction and Maintenance, in July.

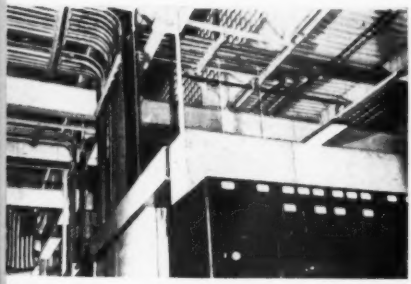
This issue of the magazine that has paced the growth of the industry for half a century will show 23,750 electrical contractors, plant chief electricians and consulting engineers what's ahead – and what to do about it. And it will round up the latest developments, most modern practices and methods in a working guide book for the 50's.

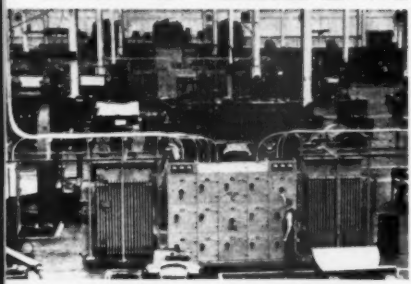
Launch your program for the 50's by describing, in detail, the products and services your company can offer. The men who will open the new electrical construction and maintenance frontiers – and help to double your sales – will be looking for your message in this important issue.

FIFTIETH ANNIVERSARY ISSUE

NEW FRONTIERS FOR THE 50'S

CLOSING DATE: JUNE 5TH





THE JULY NEW FRONTIERS ISSUE will have 6 Big Feature Sections . . . (each with its own advertising section)

THIS GROWING INDUSTRY

Load growth and the pattern of growing electrical needs
Equipment, apparatus and appliance developments – and their influence on the industry's growth

LOOKING AHEAD IN WIRING DESIGN

Reference points in Modern Design
Analysis of Loads
Service Entrance Equipment
Main Feeders and Grounding
Modern Distribution Systems
Branch Circuit Practice
Wiring for Special Areas
Signal and Communication Equipment and Installation

FRONTIERS IN LIGHT, POWER AND HEAT

Lighting: how modern systems are developing toward new standards
Motors and Controls: selection and application of motors, controls and instruments
Electric Heat: resistance, radiant and induction

MODERN METHODS AND MANAGEMENT

Construction: job organization, methods and equipment to meet modern requirements
Shop organization, methods and equipment to meet today's demands
Useful Data for Wiring Design: tables and charts
Helpful Information: books, literature and educational aids

MODERNIZATION AND MAINTENANCE

Organization and Methods: modern requirements and how they are handled
Industrial Modernization
Preventive Maintenance

HISTORICAL PERSPECTIVE

The role of electrical construction, installation and maintenance in the great electrical industry
Industry Associations and Influence
Where We Were: a look back to 1901
Where We Are: a summary of present frontiers
Where We Are Going: a look ahead

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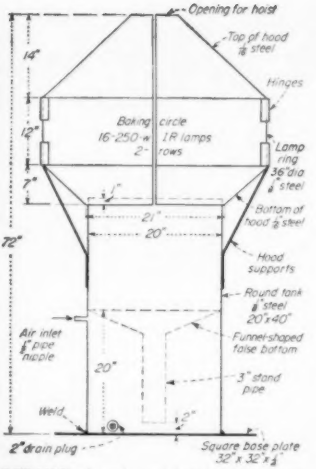


DETAILS of tank and hood construction showing pertinent dimensional data.

way mark is a shallow funnel-shaped "false" bottom with a 3-inch diameter drain which is 18 inches long. With a design of this type, forced-flow impregnation can be used.

Once the equipment has been preheated and lowered into the tank, compressed air enters the lower half of the tank through an air inlet nipple; forces the varnish up through the 3-inch stand pipe into the upper half of the tank and over the stator or armature. When the valve has been closed, this air holds the varnish in the upper tank until the motor windings have been sufficiently impregnated. As the air is released, the varnish gradually recedes and drains into the lower portion of the tank. After the stator has been left in the tank long enough to thoroughly drain, it is raised by chain hoist and positioned in the baking hood above. A metal cover encloses the tank.

The infra-red equipment, mounted to the tank with substantial flatiron brackets, consists of a 36-inch diameter lamp ring (¼-inch sheet steel) with a top and bottom enclosing hood of ⅛-inch sheet steel. The ring is 12 inches high and accommodates two rows of 250-watt infra-red lamps (eight per row) mounted in staggered fashion on 14-inch centers. The rear half of the lamp ring is stationary; the front half is divided into two sections which are hinged at the sides and can be opened and closed for loading and unloading the unit.

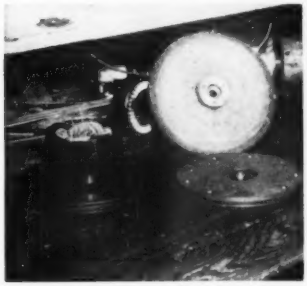
Each row of lamps is on a separate control circuit for manual or automatic operation through a time switch. Normally, the top row is used for preheat purposes (five to 10 minutes) and the bottom row for baking. If a deep stator or long armature is

in for a bake, both rows of lamps can be used. Maximum baking efficiency is gained by painting the interior of the hood with a heat resistant aluminum paint. The exterior of the entire unit is painted black. Normal baking time for motors of 5 hp size is about two hours; for larger units is correspondingly longer.

Man-hour economy is not the only feature of this combination unit. Nussbaum personnel find that it has proved a considerable aid to good housekeeping. Dripping motors no longer must be moved from tank to oven and varnish clean-up is held to a minimum.

Turntable Aids Motor Repair

In repairing fractional-horsepower motors, it is of considerable help when the motor frame can be rotated freely on the work bench. This is possible in the shop of the Tennessee Electric Motor Service of Nashville,



TWO PLATES, the upper one fitted with a spindle, the lower one containing ball bearings, constitute a revolving turntable which is of definite assistance in repairing small motors in the shop of the Tennessee Electric Motor Service organization, Nashville.

through the use of a turntable plate constructed in the TEMS shop. The turntable consists of two plates, the top one containing a spindle bushing and the bottom one fitted with a hub and nine ball bearings. The motor is placed on the upper plate and the whole assembly can be revolved in accordance with the requirements of the worker.

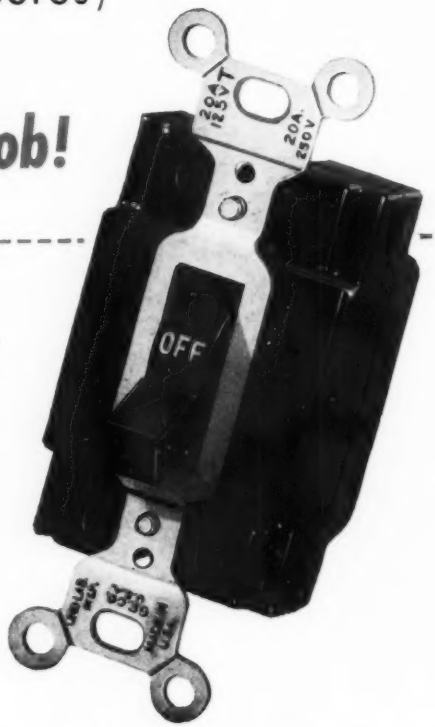
FRONTIERS FOR ELECTRICAL PROGRESS

The July issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE will include an appraisal of modern practices and trends in load analysis for wiring design.

G-E HEAVY-DUTY SWITCHES

(for 20 and 30 amperes)

Built to stay on the job!



Tough construction and smooth action are the double features that make G-E heavy-duty switches important wiring news!

These tough, T-rated switches are protected by an over-all plastic housing. Housing is extra shallow for extra wiring space in boxes. Pressure connectors, designed for convenient back wiring, make installation quick and easy.

General Electric heavy-duty switches are available in single-pole, 3-way, double-pole, and single-pole quadruple break types.

WIRING DEVICES
for home and industry

Try G-E heavy-duty switches at your most troublesome locations. See why they can take abuse in stride. For complete information write Section D65-518, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

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We suggest that you tear out the bottom card before you start reading the following pages. Keep the card handy. You might even use it as a book mark in case you are unable to complete reading the following pages at one sitting. Then, as you see some new products about which you want to know more, just circle on this card the number which appears at the top of the item describing the new product or catalog. Circle each number on this card which corresponds to the number on the item in which you are interested.

If you want to know more about something which is advertised in this issue, put the number of the page on which the advertisement appears in one of the squares at the bottom of the card. If you want further information on the product advertised on page 16, for example, just put a 16 in one of the squares. When more than one advertisement appears on a single page, include the manufacturer's initials together with the page number (16-A&B)

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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

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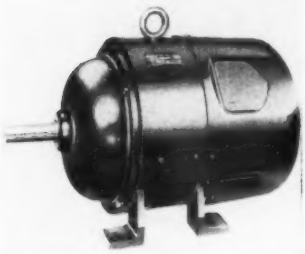
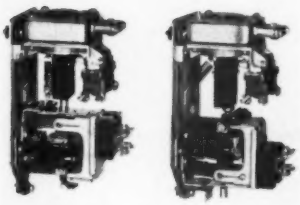
Product News



Motors (1)

New totally-enclosed, explosion-proof dc Life-Line mining motors, either non-ventilated or fan-cooled, are available. These motors conform to designs approved by the U. S. Bureau of Mines for use in gassy and dusty mines. They will withstand an internal explosion, and will not ignite an explosive mixture outside the motor. Motors feature all-steel construction. Pre-lubricated, double-sealed ball bearings provide effective lubrication without attention for life of bearing. All field and armature windings are impregnated in thermoset varnish. Power cable is brought out through packing glands. Rotating flame seals at each bearing, long rabbet fit between frame and brackets, and screw-type brass access covers assure explosion-proof construction.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.



Pneumatic Timer (2)

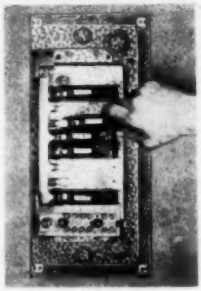
Designed for timing machine tool cycles, conveyor systems, and similar industrial operations, Class 9050 Type R pneumatic timing relay has a new invertible magnet. Depending upon the position of the actuating magnet, contacts operate with delay either after energization or after deenergization of magnet. The timing range is adjustable from .2 seconds to 3 minutes. Accuracy is within 10%, and is independent of normal variations in voltage, ambient temperature, at atmospheric pressure. Operation of timer is based on principle of air transfer between two chambers through a restricted orifice. Silver-to-silver, snap action contacts have pilot duty ratings up to 600 volts, ac or dc. Unit is available in NEMA I, IV and VII enclosures. Type R, ac timers can be furnished with operating coils for voltages up to 600 volts, 25 to 60 cycles. Type Q, dc timers are available with operating coils for voltages up to 250 volts dc.

Square D Company, 4041 North Richards St., Milwaukee 12, Wis.

Cable Entrance Seal (3)

Announcement has been made of a new type "RS" Resistoyl bushing cable entrance seal. It uses bushings of Resistoyl rubber material compressed in a stuffing box to form a pressure-tight, oil- and moisture-proof seal on all types of leaded and non-leaded cables. Bushings are held between metal discs and compressed by tightening a gland nut. Since the Resistoyl bushings are part of the cable entrance, the proper mass of material to form an effective seal is always present when the entrance is installed. Fittings for use with conduit and wire or tape armor are available for use with the "RS" cable entrance. Types "RS" and "RSF" cable entrance seals are made in three flange sizes to fit the three standard base sizes of G & W potheads and cableheads.

G & W Electric Specialty Co., 7780 Dante Avenue, Chicago 19, Ill.



Load Centers (4)

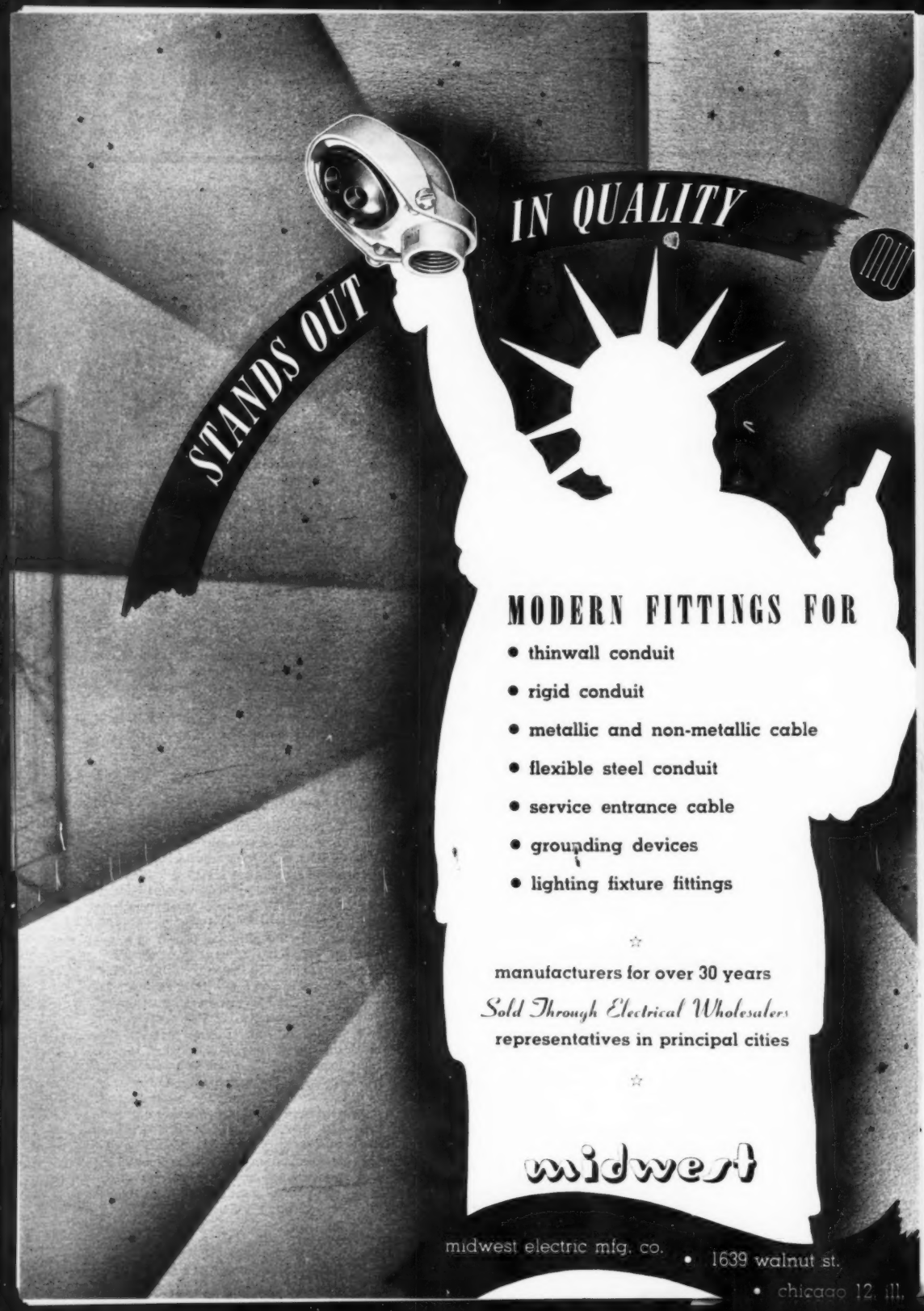
New load centers and service equipment, known as the Add-On type, have been announced. They are assemblies of either Thermag or Quicklag circuit breakers. Designed for residential and small commercial installations, the new units are available in five sizes of enclosures—8, 12 and 16 circuits, single row and 12 to 20 circuits, double row. Basic units have four single pole, or two double pole. Features of the new units are screwless assembly and one pressure type connection between circuit breaker and busbar. Breakers are interchangeable and installed by slipping them into place.

Frank Adam Electric Company, 3650 Windsor Place, St. Louis, Mo.

Tape (5)

Announcement has been made of a new vinyl electricians' tape. Known as Permacel 29 vinyl electricians' tape, it is intended primarily for use in the electrical and automotive industries. It is of 7 mils. thickness, with insulation resistance of 88,000 megohms at 91% relative humidity and 67,000 megohms at 96% relative humidity. It has 200% elongation. Its backing is black vinyl film, of 5.5 to 6 mil. thickness. Permacel 29 has Underwriters Laboratories' approval. It will do the work of both rubber tape and friction tape in splicing wires. Also it is designed for use around television antenna crossbeams, in battery cable winding, and ignition systems. It is used for moisture sealing headlights or spotlights, protecting generator wiring, brake cables, binding wire harnesses, protecting tool handles, preserving power cables which are dragged along the ground, etc.

Industrial Tape Corp., New Brunswick, N. J.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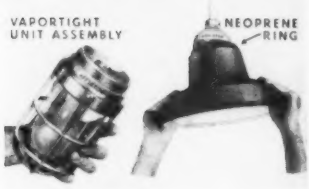
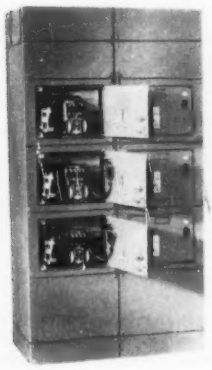


Lighting Fixture (6)

Announcement has been made of a new line of convertible vaportight lighting fixtures for mounting on rigid conduit, known as the "V-51" Series. The line includes 18 types of malleable iron fixture bodies for pendant, ceiling or bracket mounting. Bodies are threaded to take both the 100 watt or 150-200 watt lamp receptacle-globe-guard assemblies. All bodies except bracket types are grooved to mount 100, 150 or 200 watt reflectors in a choice of four styles—standard dome, shallow dome, deep bowl or 30° angle. Reflectors are steel with green baked porcelain enamel outside, white enamel inside. Receptacle assemblies and snap-on type guards are aluminum. Navy standard vaportight globes are available in clear glass, a variety of colors or heat-resisting types.

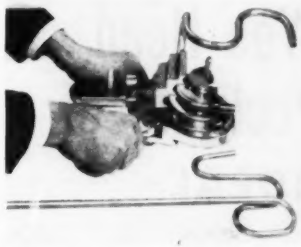
Appleton Electric Company, 1701-59 Wellington Avenue, Chicago, 13, Ill.



Control (7)

Announcement has been made of the development of new Multitrol control centers designed for accommodating any control system up to 600 volts, using components not larger than NEMA Size 5. Primary applications are for refrigeration and air conditioning systems, industrial plant machinery, generating plant auxiliaries and similar installations where a group of motors can be independently or interdependently controlled from a central location. Prefabricated units containing control for a single motor are assembled and wired into a free standing steel enclosure section. Any number of sections may then be bolted and bussed together to form a control center. Available with magnetic full voltage starters, reversing or non-reversing; multi-speed starters; primary or secondary resistance starters and autotransformer starters. Standard starters are equipped with externally operated circuit breakers, thermal overload protection and low voltage protection.

Ward Leonard Electric Co., Mount Vernon, N. Y.



Bender (8)

Announcement has been made of a new tool for making offsets and bends up to 180° in $\frac{3}{8}$ in., $\frac{1}{2}$ in. and $\frac{3}{4}$ in. O.D., K and L copter tubing, brass, Bundy weld, steel and other light gage tubing. It is called the "3 in One", Model No. 1200, as all three sizes are combined in the one tool. It is made of strong light weight metal. No vise or fixtures are required. It is recommended for use in the refrigeration line, for radiant heat coils, for airplane manufacturers and others, in repair shops and in all places where copper tubing is to be bent. Weight is 5 pounds.

Tal Bender, Inc., Milwaukee 2, Wis.

Transformer Panel (9)

A new swing-out transformer panel which facilitates servicing and adjustment of Bob-Cat electric cable hoists has been announced. On this hinged panel is mounted the supply line transformer which reduces current at the pushbutton control to 110 volts. By swinging this transformer and its contactors out of the way, motor brake is made readily accessible for routine adjustments. The panel eliminates the necessity for removing attachment bolts or disconnecting electrical leads. It is standard equipment on all Bob-Cat models having pushbutton controls.

Cleveland Chain & Mfg. Co., Cleveland 5, Ohio

Motors (10)

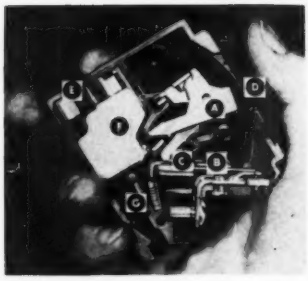
A new line of explosion-proof mining motors, conforming to the Bureau of Mines Schedule 2E, has been announced. Line is available in ratings from $\frac{1}{2}$ hp. through 60 hp. at 230, 250, 500 and 550 volts, with stabilized shunt, compound, or series windings. All frame sizes in line utilize two stud brush mechanisms. Motors also use a cable gland design which permits cable replacement without removing end shield or working through commutator access openings. High dielectric insulation is applied to coils with a vacuum impregnating process using Glyptal synthetic resins. All windings are given a finish treatment of 1201 red Glyptal enamel which provides a moisture resisting insulation. Standard motors are foot mounted.

General Electric Company, Schenectady 5, N. Y.

Transformer (11)

A new Safeway LoVolt step-down transformer with a 6 volt secondary has been announced. It is a safe portable unit for boilers, tanks, chemical plants, railroad shops, generating stations and other hazardous locations. Unit is a double wound transformer, tested to withstand 1600 volt breakdown, windings isolated, 3 wire primary for safety. Cords enter through sealing glands, covers bolted together at center with lock seal feature, and no water or moisture can enter. It is made from oil resisting synthetic rubber, can be used in presence of oils and most chemicals, with no deterioration.

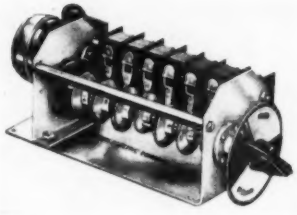
Daniel Woodhead Co., 15 N. Jefferson St., Chicago 6, Ill.



Load Centers (12)

Unique construction and packaging of the new line of Trumbullite load centers enable the distributor and contractor to maintain a complete range for residential and commercial applications, with minimum stocks. One and two circuit load centers are shipped assembled. Four through 20 are shipped in such a way that they can assemble a completed device to satisfy any requirement. The enclosure, consisting of box, interior and two 15 amp circuit breakers, are placed in one carton. Fronts, surface or flush, are packaged in individual envelopes. Each load center front is provided with two punched breaker openings; additional circuits are added by removing twist-outs. Circuit breakers which are interchangeable in all ampere ratings, are individually packaged.

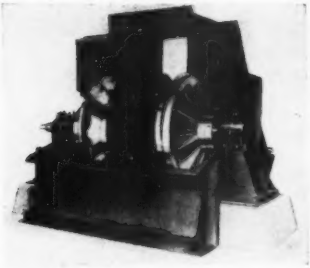
Trumbull Electric Mfg. Co., Plainville, Conn.



Timer (13)

A newly developed multiple circuit cycle timer has been announced. It is for timing laundry and dry cleaning machinery operations, electrical display signs, industrial furnaces, electrical appliances. It may be set for on and off periods with as many circuits as desired. Unit can be furnished without synchronous motor for elevator control, limit switch and similar applications. Mechanism of unit is a bank of S.P.D.T. micro switches operated by adjustable cams driven by a synchronous motor.

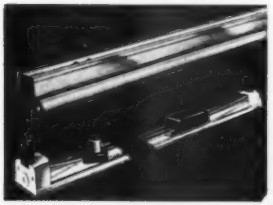
Zenith Electric Company, 152 *West* Walton St., Chicago 10, Ill.



Fan Control **(14)**

Control of fan output from 15 to 100% of full load is provided by a new type of vane control available. Designed for use with fans for mechanical draft, industrial applications, and ventilating service, this vane control saves power. No change in speed of either fan or motor is necessary because vane control changes spin of entering air to modify fan pressure. This provides instant response and permits use of constant-speed squirrel-cage motors. Four models are available: model 6 used with light duty fans; 7 for handling of dusty gas; 8A for industrial applications where gases are free from solids; 8B for industrial and ventilating service where shaft bearings are supported on fan casing.

Westinghouse Electric Corporation, Sturtevant Division, 200 Readville St., Hyde Park, Boston 36, Mass.



Channel Strip **(15)**

Announcement has been made of TRA-BAK, channeline strips. They are specially designed channel strip which permits easy access to wiring and connections of fluorescent fixtures during installation and maintenance. Ballast, starter, sockets and all wiring are on an open channel for quick installation or repair. For continuous row installations, no special couplers are needed, only a threaded nipple and two locknuts are required. The TRA-BAK inverted raceway permits flush mounting on walls as well as ceilings. Strips can be mounted horizontally or vertically at bottom, top and sides of show windows, counters, shelves; on either side of doors, mirrors and wall

panels in homes; and for all-around utility illumination purposes in shops, factories, office buildings, hotels, theatres and cafes. Each assembly is wired with remote starter base, starter, ballast and lampholders. Knockouts on back and on each end for all types of installations.

Great Northern Mfg. Corp., 4217 Harrison St., Chicago 24, Ill.

Timer (16)

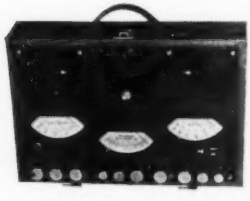
A new synchronous-motor timer for control of a wide variety of timed operations has been announced. This type SY "Promatic" timer can be used for all time periods between ½ second and 24 hours. It actuates five s.p.d.t. load contacts independent of timer-control circuits. There are two separate solenoids—one operates the clutch and timing mechanism, the other actuates the load contacts. Timer automatically rests for each new cycle. Timer is available for either 115 or 230 volts ac. Outside dimensions are 4½ inches wide, 4⅛ inches deep and 8 inches high, including terminal strips.

General Control Company, 1200 Soldiers Field Rd., Boston 34, Mass.

Control (17)

Announcement has been made of a new Capaciline "straight line" control, which anticipates the fuel needs of controlled heating equipment. By anticipating the heat transfer lags (thermo-inertias), it automatically reduces the on-off variations of a control instrument above and below the preset control point, enforcing a straight line control on the heating variable. Control with the Capaciline over ovens, furnaces, kilns, vats, molding or extrusion machines, saves fuel, eliminates spoilage, prevents "over or under-shooting" and provides continuous uniform production. Unit is available as a small self-contained unit or as a built-in feature of electronic controllers and strip chart recorders.

Wheelco Instruments Company, 847 West Harrison St., Chicago 7, Ill.



Instrument (18)

A new industrial analyzer, Model 102, has been developed for testing signal and alarm circuits, for servicing industrial electronic and communication systems, for testing motors and lighting loads, and for general maintenance of power systems. Its ranges cover: dc volts 1/5/25/125/250/500 and ac volts 5/25/125/250/500, both at 1000 ohms per volt; dc current mv. 50 and 100; ac current amps., 250/1/5/25; ohms 0-1000 and 0-1 megohm. Scale length is 3.5 inches. Features are interlocking pushbutton switching for almost simultaneous volt and ampere readings; precision wire-wound resistors, fully shielded high torque-to-weight meter, low drain ohmmeter circuits.

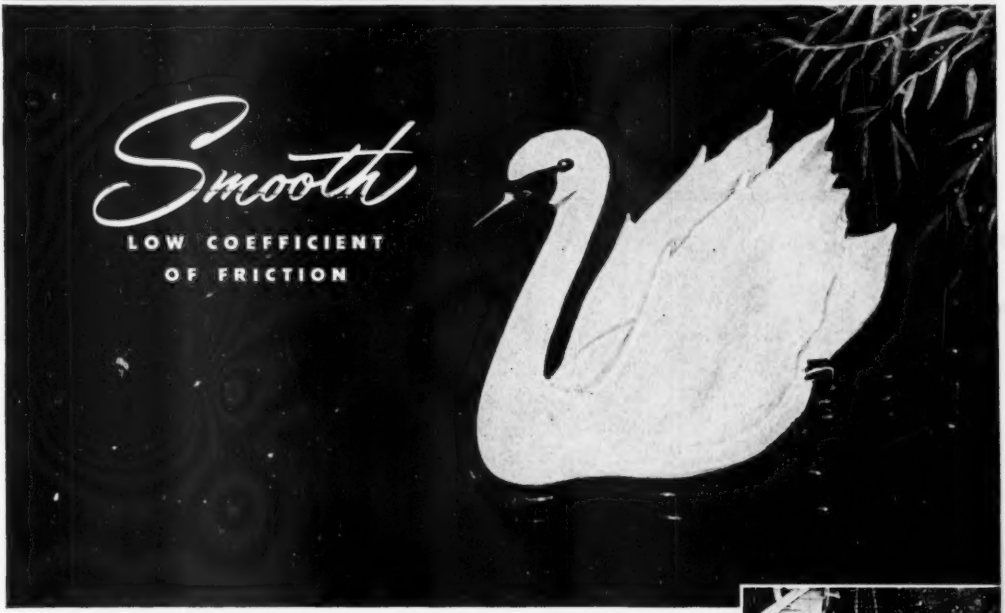
Instrument Laboratories, 319 West Walton Place, Chicago 10, Ill.

Transformer (19)

A number of improvements have been made in the CSP transformer, which have been incorporated in all ratings. Two padlocks will now lock

ORANGEBURG *Fibre* CONDUIT

STANDARD *installed with Concrete* · **NOCRETE** *installed without Concrete*



Orangeburg's *smooth bore* protects cable sheath from abrasion when pulled in . . . and Orangeburg's low coefficient of friction keeps pulling tensions on cable to minimum.

Orangeburg's impermeable wall and tight joints safeguard the cables from infiltration of ground waters and other corrosive elements throughout their long life underground.

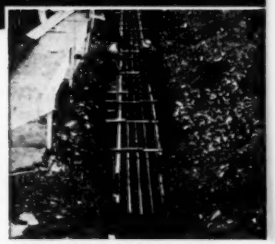
AND THE CONTRACTOR FINDS ORANGEBURG INSTALLATIONS CONSISTENTLY PROFITABLE

Orangeburg lays fastest and at lowest cost of any conduit . . . because of its light weight, long lengths and ready workability in the field.

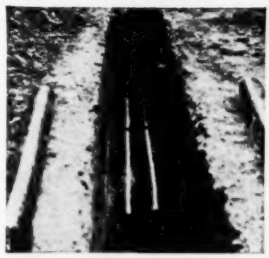
STANDARD—For three or more ducts . . . use ORANGEBURG STANDARD *with* concrete encasement.

NOCRETE—For one or two ducts . . . ORANGEBURG NOCRETE . . . installed *without* concrete encasement . . . proves profitable when conditions favor its use.

The Orangeburg trademark identifies *all* Orangeburg Conduit. SEND FOR *Free* Illustrated Folder. Write to Dept. EC-5, Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.



STANDARD



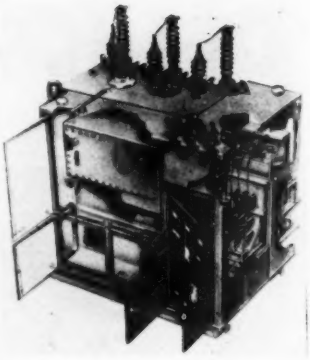
NOCRETE

Graybar ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

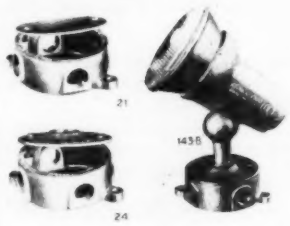
GENERAL ELECTRIC SUPPLY CORPORATION

Branches and Stocks in Principal Cities



up four doors on front. Auxiliary compartment on rear has been eliminated. Potential transformers are of the draw-out type to make fuse changing more convenient. Arrester bracket is welded to tank on high voltage side to lower profile. All standard ratings are now Sealedaire. When necessary extra potential transformers will be put on roof of transformer. Ventilators have been eliminated from wall panels and stretcher level steel is used in door and wall panels.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

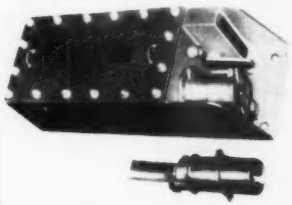


Junction Boxes (20)

New, heavy-duty weatherproof junction boxes made of non-corrosive, cast aluminum have been announced. They include a variety of covers and fittings for universal use on almost any outdoor wiring or lighting job. The box has four hubs tapped ½ inch IPS, is provided with or without mounting lugs, has a flat aluminum cover plate sealed with a cork gasket and a separate cast aluminum cover tapped ½ inch IPS to take standard lampholders for the 150, 200 and 300 watt outdoor weatherproof reflector bulbs. Used with lampholders and mounted on walls where buildings form boundary lines, unit is especially effective for property-line lighting, for protective floodlighting of areas between buildings, for

yard lighting, and loading platforms. Units are approved by Underwriters Laboratories.

Stone Manufacturing Company, 489 Henry Street, Elizabeth 4, N. J.

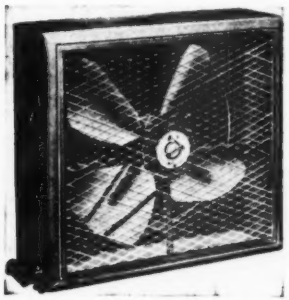


Outlet Breaker **(21)**

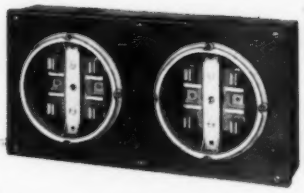
New pier outlet breakers, offering a simplified standard method of supplying auxiliary power to ships at any dock or base, are available. They can be placed along docks or piers, providing full protection for power cables and convenient disconnects. The units use type AQB circuit breakers of class H1 design, in accordance with Navy Department specification 17B1 covering air circuit breakers, electric, for shipboard use. These breakers are available for either 250 volt dc or 440 volt ac, two or three pole service, with trip ratings from 70 to 600 amperes. If more power is required, units can be installed in groups. Receptacles can be supplied for either three or four wire service.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

(22)



WINDOW ATTIC FAN, which is electrically reversible by the flick of the switch, has been announced. Completely enclosed with grill in front and back. May be used for upper and lower window or as an attic fan. Available in two sizes —WR24 with 24 inch blade and WR30, with 30 inch blade. Manufactured by Circulators & Devices Mfg. Corp., 128-168—32nd Street, Brooklyn, 32, N. Y.



Socket Meter Troughs (23)

Announcement has been made of a new line of socket meter troughs. They are available for either indoor or outdoor installations—surface or flush mounting. Sockets are rated 100 amp and accommodate up to six jaws, convertible to either horizontal or vertical positions. Terminals accommodate up to No. 1 wire. Cover and ring are removable, leaving socket base and terminals in place. Extra jaws can be added in the field. Raintight enclosures are designed to include interchangeable hubs. Combinations of sockets and service entrance equipment within the same enclosure are also available.

Square D Company, 6060 Rivard St., Detroit 11, Mich.

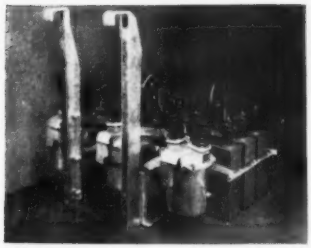
Alarm (24)

Photoelectric intrusion alarm set P1A provides intrusion and burglary protection for offices, stores, government and industrial properties. Set consists of control type A20C-2 and light source type L60B. An invisible infrared beam is projected from the light source, spanning any distance up to 50 feet. This is aligned to strike the "eye" of the control. Momentary interruption of the infrared beam actuates the control relay, which is wired to operate and sustain an external alarm device. Alarm can be silenced by restoring the electrical circuit to original conditions by use of a manual or automatic reset switch. A tamperproof sensitivity adjustment on the control permits operation over varying distances between the control and light source.

Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass.

Capacitors (25)

A small pole-top packaged capacitor bank is now available. Equipment consists of nine 25 kva capacitor units and three solenoid-operated type CSO-1 switches. Only three line and three control wire connections are required



to put the equipment into service. The CSO-1 switch will operate approximately 5000 times before requiring maintenance. Unit is available with either nine or 12 capacitors, rated 15 or 25 kva, 2400 to 7960 volts. Time clock and voltage or current controls can be supplied.

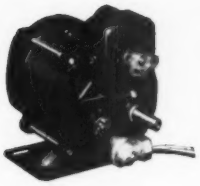
Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Product Briefs

(26) Two new sizes of the twin-helix Pengo **earth augers,** one for 10 inch and the other for 12 inch actual hole diameters, are now in production by Petersen Engineering Co., Santa Clara, Calif. . . . (27) Synchroscope Co., New York City, N. Y., has announced a new portable, flashlight-type **stroboscope** for indicating synchronous speeds. . . . (28) Southern States Equipment Corp., Hampton, Ga., has announced a new development in its expulsion power **fuse** line featuring complete voltage ratings.

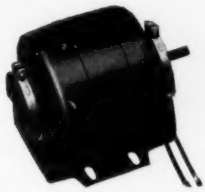
(29) Robot Appliances, Inc., Dearborn, Mich., has announced a new automatic electric **power unit** for varied applications where it is desired to automatically open or close, lift or lower, or rotate, any object by electrical or magnetic remote controls. . . . (30) An improved **flow interlock,** a device which responds to a flow of water to open or close an electrical contact, has been announced by General Electric Co., Schenectady, N. Y. . . . (31) The Cleco Division of the Reed Roller Bit Company, Houston, Texas, has announced a new heavy-duty air-operated small **drill** designated as 9DBW-28A.

(32) Circulators & Devices Mfg. Corp., Brooklyn, N. Y. has announced a new electrically reversible three speed **window fan,** WR20. . . . (33) The Tagliabue Instruments Division of Weston Electrical Instrument Corp., Newark, N. J. has introduced the TAG moisturonic moisture **meter,** an all-purpose meter for measuring the moisture content of lumber, wood, plaster and other materials of varying textures and consistencies. . . . (34) A new automatic **emergency hand lamp** that plugs into any 110 volt ac wall outlet has been developed by Electric Cord Company, New York, N. Y.

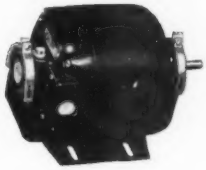


Gas Pump

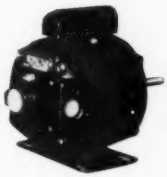
Sump Pump



Unit-Bearing Fan



Belted Fan



General Purpose

Jet Pump

AVAILABLE!

If the lines you handle include electric motorized equipment, you can obtain more motors or motor-driven products by concentrating on priority orders, *and then passing* these priorities *back to* your suppliers. It will help you get the necessary equipment faster to meet your industrial and business customers' needs for *maintenance, repair, or operating supplies.*

General Electric can supply the *standard* F-hp motors shown above, for such priority requirements faster than you might think. And user-preference for G-E motors helps you compete more successfully for priority orders.

Barring unforeseen emergencies or new rulings subsequent to the writing of this message, General Electric has facilities to handle priority motor requirements with practically pre-Korea speed. What's more, General Electric application engineers stand ready to help equipment manufacturers design or re-design products so that *standard* motors can be used to the greatest advantage.

Be sure that your suppliers know that G-E standard fractional-horsepower motors are quickly available for priority requirements.
General Electric Company, Schenectady 5, N. Y.

TIMELY HELPFUL BULLETINS

These recent bulletins have been specially prepared to help you make better use of G-E motors and services. Send for them today.

General Electric Company, Sec. C 700-116
Schenectady 5, N. Y.

Please send me the following publications on G-E fractional-hp motors:

- ☐ GEA-3989—description of all G-E Factory Service Plans
- ☐ GEA-5566—detailed explanation of how to use the G-E Motor Exchange Plan
- ☐ GEA-5174—description of standard G-E fractional-hp motors

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

GENERAL ELECTRIC

700-116

(35) Combustion Control Corporation, Cambridge, Mass., has announced a new series of Fireye flame failure safeguards and programming **controls.**

(36) U-C Lite Manufacturing Company, Chicago, Ill. has announced a new automatic **emergency lighting unit** for civilian defense, known as Big Beam Model 2-AD special . . . . (37) Westinghouse Electric Corp., Pittsburgh, Pa., has introduced an encased Precipitron **electronic air cleaner** that resembles a factory-fabricated section of an air duct or plenum chamber 96 inches long with a built-in Precipitron.

CATALOGS and BULLETINS

(38) Farm Lighting units such as aluminum or porcelain enamel fixtures with glass enclosures for outlet box or conduit mounting are subject of bulletin 122-51. Steber Manufacturing Co.

(39) Metallizing for maintenance, repair and production problems is subject of 20-page bulletin published by Metallizing Company of America.

(40) Batteries for marine service are discussed in 8-page information booklet punched for insertion in 3-ring binder. Electric Storage Battery Co.

(41) Spotlight for high ceiling applications, offering 2 intensities and wide-range adjustment, is described in bulletin 129B published by Swivelier Co., Inc.

(42) Vibration isolation is subject of bulletin 607 released by Barry Corporation.

(43) Tachometer for stationary mounting is specified on bulletin sheet 794 by Herman H. Sticht Co., Inc.

(44) Wiring Devices and incandescent lighting fixtures are illustrated in 40-page catalog 18 published by John I. Paulding, Inc.

(45) Ground Testing instruments for checking soil, anode- and circuit-resistance are presented on data sheets 26-43. Associated Research, Inc.

(46) Ventilating Equipment including pedestal, wall and ceiling fans, blowers and shutters are discussed in 1951 catalog. Circulators and Devices Mfg. Co.

(47) Circuit Breaker catalog listing coil resistance curves, principles of operation, details of construction, standard time overloads and coil connections, is available from Heinemann Electric Co.

(48) Selenium Rectifiers, their characteristics, applications and design factors, are subject of 16-page catalog. Selectron Division, Radio Receptor Co., Inc.

(49) Radial Saws with 14-16-inch blades, for cross-cut, miter, bevel, tongue-and-groove, dado, rabbet, flute and rip purposes, are discussed in new file folder published by Skilsaw, Inc.

(50) Multitrol add-a-unit switching centers for versatility of assembly are subject of bulletin 4410. Ward Leonard Electric Co.

(51) Squirrel-Cage motors, polyphase, totally enclosed, fan-cooled, of cast-iron construction, are discussed in pamphlet prepared by Wagner Electric Corp.

(52) Electric Hoists for heavy duty are described and specified in 6-page folder. Ohio Hoist and Manufacturing Co.

(53) Vaportight Lighting fixtures with unit assembly are fully described in 20-page bulletin 5-A. Appleton Electric Co.

(54) Temperature Controller, direct reading, self-contained, is subject of bulletin 292-I. Wheelco Instruments Co.

(55) Home-Planning for electrical contractors, discussing available electrical equipment by rooms, is subject of 20-page booklet B-4760. Westinghouse Electric Corp.

(56) Blast Cleaning with soft abrasives is discussed in 4-page bulletin describing portable cleaning machine. Bulletin 118. Pangborn Corp.

(57) Motor Controls for synchronous machines are discussed in 8-page 2-color bulletin. Electric Machinery Mfg. Co.

(58) Electrical Connectors and installation tools with suggestions for selecting and ordering are contained in catalog Y53. Burndy Engineering Co., Inc.

(59) Materials Handling equipment, including scales, hoists and trucks, are discussed in 44-page bulletin. Yale and Towne Mfg. Co.

(60) ADJUSTABLE SPEED drives for calendering rubber, plastics and similar materials are illustrated and discussed in 8-page bulletin GEA-5588. General Electric Co.

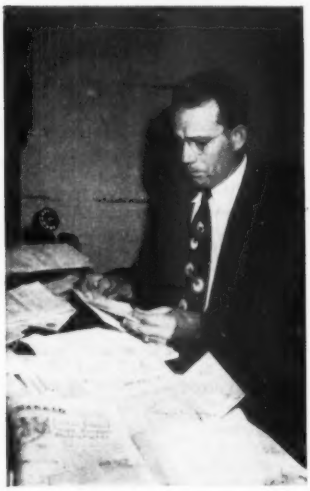
(61) POTHEADS of the capnut, disconnecting and straight-through types are thoroughly discussed, specified and illustrated in 72-page bulletin published by G & W Electric Specialty Co.

(62) RESISTANCE TESTERS, low-cost, including the midget Megger insulation tester, CVM type Megger insulation tester and midget Megger circuit testing ohmmeter, are discussed in bulletin 21-85. James G. Biddle Co.

(63) MULTI-PUMP MOTOTROLS for operating elevated tank systems with two or more pumps are illustrated and described in bulletin 1210. Automatic Control Co.

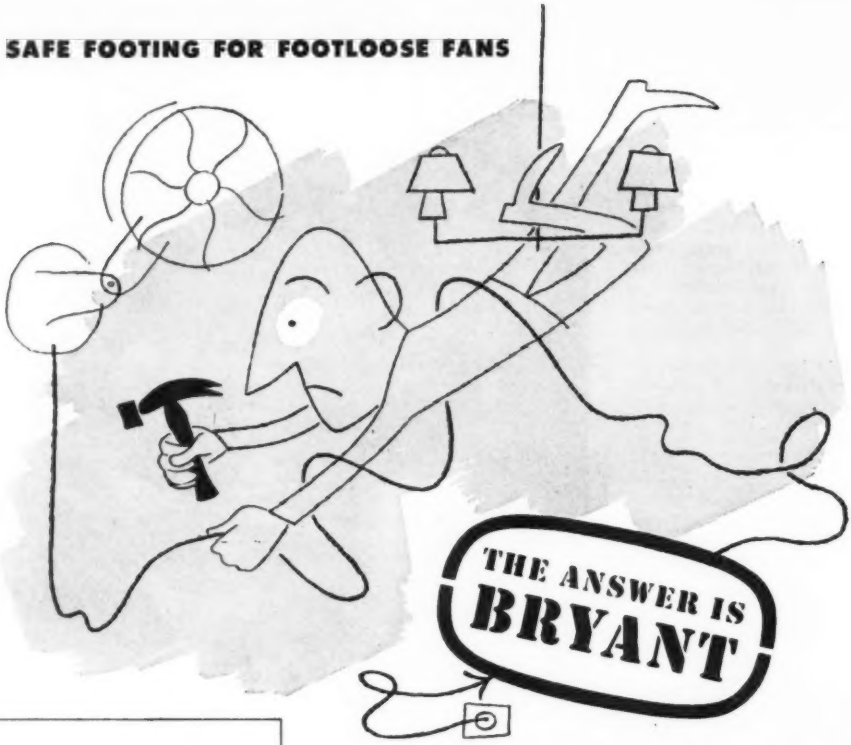
(64) SILVER BRAZING ALLOYS, discussed in terms of six "do's" and two "dont's", are fully covered in small folder. All-State Welding Alloys Co., Inc.

(65) ELECTRICAL TAPES for construction and maintenance are discussed in brochure published by Minnesota Mining and Manufacturing Co.



DIVERSIFICATION of work poses many problems for W. B. Williams, owner of Perry Electric Co., Newport News, Va. It also keeps him busy, as recent jobs include a new $1 million school, a new street lighting system, and many stores, offices, industrial plants, and other commercial types of installations. His big headache today, he reports, is obtaining copper wire and cable in quantities and sizes required for contracts in progress.

SAFE FOOTING FOR FOOTLOOSE FANS



WITH NO. 3751 FAN HANGER OUTLET

Dangling, unsightly cords are no problem when you use the Bryant 3751 Fan Hanger Outlet. The entire weight of the fan, either fixed or oscillating, is supported by an adjustable stud entirely separated from the electrical connection. Fan cord may be shortened for neat appearance.

Cadmium-plated steel sub-plate supports the outlet covered by a brass flush plate. 15 amperes, 125 volts; 10 amperes, 250 volts.

Listed as Standard by Underwriters' Laboratories, Inc.

BRYANT
SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

CHICAGO • LOS ANGELES

SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL DISTRIBUTOR

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Motor Problem

QUESTION U-17—*How can I convert the wattmeter reading of a 3 phase motor with locked rotor into lbs. torque?*—C.H.H.

ANSWER TO U-17—C.H.H. asks to have a wattmeter reading converted into "lbs. torque". Torque can be indicated in footpounds, but not in pounds alone. The formula for converting watts into footpounds is—1 watt equals 44.26 footpounds per minute.—W.B.M.

ANSWER TO U-17—The wattmeter reading of a 3 phase motor, with locked rotor, cannot be converted directly into ft.-lbs. of torque.

It is necessary to make a complete locked-rotor test in which voltage and current, as well as power, are measured. This test is made at reduced voltage to limit the torque and current. The motor is assumed to be equivalent to a series circuit with an impedance made up of rotor and stator resistance and leakage reactance. With the readings mentioned above, it is possible to calculate the rotor resistance per phase —R_2.

The formula is:

$$\text{Torque (ft. = lbs.)} = \frac{3\ I^2\ R_2\ (7.04)}{RPM}$$

Where RPM is the synchronous speed of the motor and I is the starting current at rated voltage (by extrapolation). The torque as given by this procedure is only approximate.—P.S.

ANSWER TO U-17—You cannot determine the locked rotor torque at the pulley from merely reading the input watts from a meter as you suggest.

Watts, like horsepower, indicate rate of doing work whereas torque has not such an indication; therefore, it is not readily convertible and in this static condition not convertible. If pulley were moving, you could estimate torque as follows:

$$\text{where H.P. equals } \frac{NT}{5252}$$

$$\text{or T equals } \frac{\text{H.P. X } 5252}{N}$$

where N equals rpm of pulley and T the torque in lb.-ft. You already have input watts. Divide this by estimated efficiency to get equivalent output watts and in turn divide this by 746 to get output HP. For torque at pulley in lbs., divide this result by radius of pulley in feet.

The above, however, is not applicable if pulley is not moving—if it is not moving, no mechanical work is being performed hence there is no possible conversion to the input watts. The only work you are doing then with a locked rotor is the consuming of electrical power into electrical losses.

It is possible to determine what you are after by input electrical measurements to be sure but it is much more involved than the use of just one watt meter on input side. Such a method is the electrical or stray power method of determining motor efficiency.—E.A.M.

ANSWER TO U-17—I prefer using a scale for checking lbs. torque instead of a watt meter and a locked rotor 3 phase motor. The locked rotor motor cannot be left in circuit for long, and develops errors due to winding temperature changes even though the motor was calibrated by using a prony brake, dynamometer, or pump.—H.S.

Circuit Grounding

QUESTION V-17—*We have recently had occasion to install a 2400 to 440 volt, three phase transformer bank in delta-delta, and were considerably concerned over the best method of grounding the secondary. There are, of course, three methods: ground one corner of the delta, ground the midpoint of one leg, or leave the system ungrounded. Can some reader advise the advantages and disadvantages of each?*

In this case the code would not require grounding, but what would be the proper method of grounding a lower voltage secondary where grounding is required?—D.H.N.

ANSWER TO V-17—Circuit grounding is used to limit the circuit voltage in case of lightning or accidental contact with circuits of a higher voltage. One line may fall upon another. Breakdowns between high and low voltage coils of transformers are on record.

Except in certain instances, low voltage circuits must be grounded. Such circuits are generally accessible to unqualified persons. High voltage circuits are better constructed and are inaccessible to unqualified persons. In case of faults, disturbances in high voltage circuits tend to be more severe, so grounding is often omitted. 440 volts is in the twilight zone at present, but a strong trend is toward grounding.

Grounding the mid-point of one leg of a transformer bank doubtless is carried over from the early practice of taking combined lighting and power loads from a 220 volt delta secondary. If this practice was used on a 440 volt bank, the maximum voltage would be in the order of 380. But when he gets a shock, no man can judge the differance between 380 and 440 volts and the likely results would be the same in either case.

One well-known large American industrial firm uses 440 volt power in its plants. Construction standards require that one corner of the delta be grounded. The magnetic starters are connected so that the holding coil is connected to the grounded conductor. This firm's engineers claim that they have had the experience of motors being started because of a ground in the control circuit, even when the transformer ground was on the midpoint of one leg.—L.E.B.

ANSWER TO V-17—Where low voltage systems are fed from transformer banks whose primaries are fed from high voltage lines, it is advisable to somehow ground the low side. Otherwise, there is a possibility that a heavy lightning surge on the primary feeders will cause the low side voltage to ground to swing high enough to be dangerous to insulation. This may happen because of the interwinding capacitance of the transformers.

Aside from this advantage of grounding the low side, the choice of whether or not to do so, and, if so, how to go about it, will depend on the particular application in mind.

The single advantage of an ungrounded system is that an accidental short circuit to ground will not cause a fuse to blow or a breaker to trip.

If 220 volts, single phase, is required, then the center point of one transformer secondary may be grounded, giving 220 volts to either outside terminal. If this could be used to supply 220-volt lamps and other single-phase loads, the cost of a step-down transformer might be saved.

On the other hand, since the NEC

does not specify grounding for such a system, one corner of the delta could be grounded and run through the system as a so-called solid neutral. Bare wire could be used for the grounded leg, and since the NEC does not require switching in the grounded leg, two-pole switches, breakers, and starters could be used. Two points, however, should be called to attention. First, be sure that all three conductors, including the grounded one, are pulled through the same conduit. Otherwise, excessive heating of the conduit may result from eddy currents. Second, make sure that all two-pole starters used have two overload relays, one in each leg. A considerable saving in materials might be effected by employing this system.—J.W.T.

Fluorescent Starters

QUESTION W-17—*What difference is there between a 32 watt fluorescent starter button and a 40 watt fluorescent starter button, since both can be used interchangeably?—H.S.*

ANSWER TO W-17—There is not the slightest difference between the 32 and 40 watt starters, particularly those designed to be used interchangeably. The amount of variation in current flow is so slight as to make it commercially uneconomical to design separate sizes and, for all practical purposes, no harm results from using this starter within the range of 32-40 watts, as well as no operating difficulties.—W.B.M.

ANSWER TO W-17—There is the same difference between 32 watt and 40 watt starters, that there is between any other starters of different ratings.

There are times, under best of conditions, when they can be interchanged, and they will operate. This means the starter and bulb, both have to be in very good condition, also the power factor, voltage, and temperature have to be just about right.

If you will do some additional experimenting with them, I am sure you will agree that neither one is really dependable when used in place of the other.—M.C.T.

ANSWER TO W-17—The life of the hot cathode fluorescent lamp is dependent upon such factors as operation from ac circuits at rated voltage, the use of properly designed auxiliary equipment, and the burning hour per start.

When a fluorescent lamp, operating with an automatic starter, reaches the end of its life through deactivation of

the cathodes, the starter will try to start the lamp each time the arc fails. The result is a more or less continuous preheating of the cathodes. Since the preheating current is in excess of the operating current by about 50%, there is a marked increase in ballast heating under this condition of operation. Where such lamps are not turned off (or replaced) promptly, the resulting temperature may cause permanent damage to the ballast and possibly ruin the starter. To guard against this condition, "cut-out" or "no-blink" starters have been brought out.

The reason a 32 watt starter and 40 watt starter are interchangeable is the fact that the ballast auxiliary are so closely alike, that the ouput is negligible. The impulse current in a 32 watt ballast is almost equal to the 40 watt ballast, thereby the thermal heater in the starter operates due to close amperage drag.—O.C.

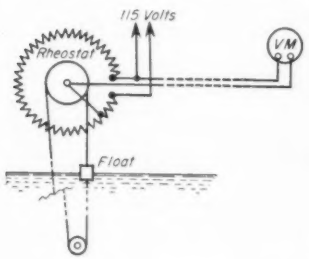
Level Indicator

QUESTION X-17—*Some distance from the plant we have a* 200,000 *gallon concrete water storage tank with floatless level controls on the pumps. We would like to install an instrument in the plant to indicate tank level. Would it be possible to use an ammeter with a field rheostat operated by a float, this float to cut resistance out of a circuit and increase current flow with an increase in water level? Have any of your readers used such a scheme?—W.P.R.*

ANSWER TO X-17—There are several ways in which a level indicator can be made.

If the tank is not too distant a ¼ inch pipe can be run to a pressure gage in the plant and the dial of the gage changed to read feet instead of pounds. An independent pipe should be used; if tapped into the main pipe it will show variations due to the flow of the water.

This method has several disadvantages such as freezing, clogging. A better method is the one you suggest, but,



using a volt meter instead of an ammeter. The potentiometer method could be used in which case only the current of the voltmeter would be taken to the plant. I would suggest using a variable resistance of about 400 ohms, in equal steps, designed for continuous operation and connected across the 115 volt system. (See Fig. A.) This will take a current of .29 amperes and consume about 33 watts. The voltmeter would be placed in the plant and connected as shown in the figure.

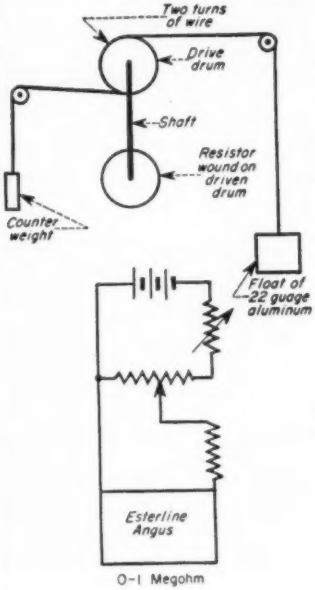
If 115 volts is available at the tank the current could be taken off there, if not, take it off at the plant, and carry one wire back from the center of the rheostat.

The amount of current used by the resistance will not affect the accuracy of the readings. The higher the resistance, the less current and the more the rheostat will cost. About ¼ ampere seems to be a good value.

The scale of the voltmeter should be changed to read in feet. If a 110 volt voltmeter is used and the movement of the float covers the entire rheostat, the pointer should cover the voltmeter scale.

A float operating a continuous chain would appear to be the best way to actuate the rheostat arm.—A.E.T.

ANSWER TO X-17—I believe that reader W.P.R. can solve his water level recording problem by adapting a scheme we use consistently for measuring stream flow in a main sewer to develop an approximation of treated water usage in the plant. In fact, I believe that the recording device will serve him even more effectively since his float will be in still water against our swiftly flowing main sewer.



As illustrated in the diagram, the installation is simple as all that is required is a float suspended from a section of stranded metal wire, as used for picture frame suspension, which is passed twice over a drum to drive a shaft connected to disk on which a coiled resistor section is wound. A fixed brush carries one end of the series circuit containing an Esterline-Angus curve drawing recorder and a fixed resistor. The circular resistance has a 2½ volt battery in series with it and a second variable resistor, used to balance the circuit. As the water level fluctuates to oscillate the drum, the resistance value varies in unison and the recording instrument gives both a visual and continuous recording.—P.C.Z.

Can you ANSWER these QUESTIONS?

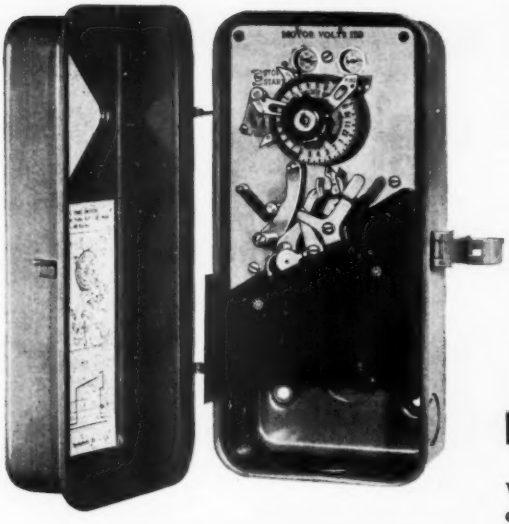
QUESTION M18—Can a two lamp 60 watt fluorescent fixture operate normally with the starters in series with both of the tubes? Ordinarily, each starter is in series with its respective lamp.—E. H.

QUESTION N18—Why does a motor start better with a capacitor in circuit? I understand that it acts almost as a 2 phase machine. If this is correct, why?—J.J.B.

QUESTION P18—In our switchyard there are several gang operated three phase 66 kv. airbreak switches that are used to interrupt the charging current on 5000 kva. transformers. These have conventional operating levers located at ground level on the steel structure. I have been told that a metal ground plate should be provided for the operator to stand on when opening these switches. Why is this necessary and if so, wouldn't an insulated platform be more suitable?—W. P. R.

QUESTION Q18—Can someone explain how I can tell the difference between type RH wire, type R wire, and type RW wire, after the markings get rubbed off?—H. S.

PLEASE SEND IN YOUR ANSWER BY JUNE 15



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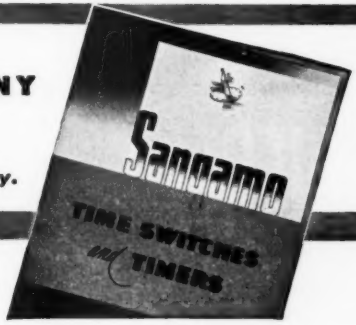

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F. N. M. SQUIRES
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.

and

Answered by
GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

and

B. A. McDONALD
Chief Inspector
New York Board of Fire Underwriters
Rochester, N. Y.

Questions on the Code

Hospital Exit Lights

Q. *What does the code say about exit lights placed in a hospital? Are they on a separate circuit, if so, how many exit signs on a circuit? If they are placed on a separate circuit, do they get their feed back of the main entrance switch?*—R.T.

A. The National Electrical Code does not in itself, require exit lights nor emergency lighting in a hospital, although it does recommend it.

It does however, require emergency lighting systems for theatres or other places where shows are given, provided the auditorium has a seating capacity in excess of 100 persons (see Section 5202 of the NEC).

In places where some local or some other code requires exit or emergency lighting for an occupancy, the provisions of Article 700—Emergency Lighting—are to be employed.

The rules in this article of the Code provide for either of two methods,—(a) an emergency lighting system independent of the general lighting with an automatic transfer switch to switch the system from a defective supply to another supply, or, (b) two or more separate and complete systems, each providing emergency lighting and with automatic transfer switches (see Section 7021).

One method of supplying a separate source of supply for exit or emergency lighting, is to make a connection to the street service on the supply side of the main service switch. This was the old time method.

Separate circuits are always best for exit lights and not more than a load of 12 amperes should be connected to a 15 ampere circuit nor more than 16 amperes on a 20 ampere circuit.—F.N.M.S.

Motor Location

Q. *A controversy has developed over the location of an air compressor motor and its controls which a local garage owner wishes to have placed in his basement. This basement is connected by ramp to the first floor and is used mostly for storage of automobiles. On some occasions a minor amount of repair work is done; however, the majority of motor repair is confined to the first and second floors of this building. If the motor and its controls for this air compressor are located four feet or more above the basement floor, will the installation comply with the Code requirements?*—H.A.

A. For many years there has been no clear-cut answer in the Code for the wiring of areas below grade. However, in the new supplement to the National Electrical Code, under Section 5102, we now have a clear-cut rule which defines the type of wiring that may be installed in areas below the grade floor. This section reads as follows: "This article provides additional required precautions in installation of electrical equipment where volatile or flammable liquids are handled or used as fuel or power in self-propelled vehicles.

Where reference is made in this article to a level of four feet above the floor, it shall be construed to mean each floor at or above grade level. In the case of floors below grade level, the measurement shall begin not at the floor, but at the bottom of outside doors or other openings at or above grade level."

Therefore, in the garage in question, if this basement is wholly below ground the National Electrical Code would prohibit the use of an ordinary motor and ordinary control equipment anywhere within that basement. If, on the other hand, this building is located on sloping ground so at least a portion of the basement on one side is above ground level with a doorway or window openings leading to the outdoors above grade on that side, an ordinary electric motor and its controls for the operation of an air compressor might be mounted upon a platform located four feet or more above the bottom of the door or window openings leading through the basement wall. If these openings lead to a ramped area so they are actually below grade level, they must, of course, be ignored in arriving at a safe location for ordinary electrical equipment as the Code definitely states such openings shall be above grade level.—G.R.

Fixtures Subjected To Ignitible Deposits

Q. *Will you please clarify the following Code ruling for me? Article 500, Section 5003, Paragraph A. "except that wiring in rigid conduit or in boxes or fittings, containing no taps, splices or terminal connections may be installed in such locations." A contractor presented this problem to me and your interpretation will be greatly appreciated. In a labeled Class*

SUBURBAN DIVISION of the Illinois Chapter, IAEI receives its charter from Fred P. Oliver, (right) chairman IAEI membership committee at Chicago meeting. Officers of new group are: (L to R) secretary-treasurer—G. E. Zisterer, Cicero; executive committee member—Harry J. Madson, Winnetka; vice-chairman—A. W. Johnson, Evanston; chairman—J. Gordon Maltby, Evanston, Illinois.

1 Crouse Hinds fixture, will it be allowable to make splice inside of this fixture? According to Paragraph A, no tap, splices or terminal connections may be installed. How is it possible to run feed wires to this fixture without having a terminal connection? Space is provided in fixture for terminal connection and also for splice of incoming feed wires and outgoing feed wires and this fixture is approved for this location.—D.L.

A. This rule, Section 5003 A, refers only to electrical equipment, which may be subjected to accumulations of readily ignitable deposits and residues, such as would occur in a paint spray booth. In such a location you could not install a fixture. In such a location, you could install rigid conduit with threaded boxes or fittings, provided no taps or splices or connections were made in such fittings. This rule practically is limited to spray booths or spray rooms. In other locations where readily ignitable deposits are not involved, you could install fixtures connected as described in your question. —B.A.McD.

Plug Fuses on 240 Volts

Q. *The National Electrical Code is part of our local electrical ordinance. Our lighting company supplies for home consumption, a common distributing system, known as "Three-wire grounded neutral". They also require the hot water heaters be energized at 240 volts, in other words, without the solid neutral.*

Our Inspector insists that since they call for 240 volts, and even though it is on this system, that the second sen-

NEW CHAIRMAN of the Illinois Chapter, IAEI, Norman H. Davis, Jr., (left) Underwriters' Laboratories, Inc., Chicago, receives congratulations of retiring chairman W. M. Schoknicht of Rockford, Illinois, at recent Chicago convention of Illinois electrical inspectors.

tence of Section 2403 does not apply and that any 240 volt device or apparatus must have cartridge fuses for over-current protection.

My contention is that the Code permits the use of plug fuses on a three wire single phase 120-240 volt system having a grounded neutral. I would like to use the Type S fuses in order to take advantage of their tamper-resisting design, as with the use of cartridge fuses anything can happen and I want to prevent the overloading of the wires by having the proper protection for them. Can you advise me on this?—W.C.H.

A. The question of the permissible use of 125 volt plug fuses on 250 volt circuits which are derived from 125-250 volt systems having grounded neutrals, is an old one which has come up many times in the past. It has always been held that where the two wire 250 volt (240 volts in the above question), is derived from a 125-250 volt system and the system has a grounded neutral, then plug fuses may be used.

This view has been held on the supposition that there would be 2 fuses, each rated at 125 volts, blowing in series across the 250 volt circuit, although it was realized that while the supposition was possible, it was highly improbable.

Approved plug fuses have been developed however, to blow safely on 250 volts.

The question as to whether the phrase "having a grounded neutral", modifies either the word "systems" or "circuits" is shown quite clearly in the second paragraph of Section 92405, in which the wording is "Systems with grounded neutrals".

Therefore according to the code, plug fuses may be used in cases similar to the one cited above, if the supply system from which the current is obtained, has a grounded neutral.—F.N.M.S.

Service Conductors

Q. *On a four wire three phase service supplied from a delta connected transformer bank, can the high side or wild phase be of smaller copper than the other phase conductors when the three phase load is approximately one-half of the 120 volt lighting load?*—D.A.

A. Under Section 2304 of the National Electrical Code, you will find the following statement: "Service conductors shall have adequate current-carrying capacity to safely con-

duct the current for the loads supplied without a temperature rise detrimental to the insulating covering of the conductors." This section also states that service entrance conductors shall have a current carrying capacity sufficient to carry the load as determined by section 2203 and in accordance with Tables 1 and 2 of Chapter 10. Inasmuch as no statement is contained anywhere in the Code which would require that conductors of equal size be used, it would be permissible to use a smaller conductor for the high side or wild phase provided that conductor complied with the first two provisions cited above. It is, of course, assumed that in no case would such a conductor be smaller than No. 8 and if the three phase load is such that a No. 8 conductor is sufficient, you will note Section 2304 a. 2 states that special permission is required from the inspection authority having jurisdiction to use a No. 8 as a No. 6 conductor is considered the smallest conductor which should normally be used to supply service to a building. The only exception to this is that permission granted in this same section for the use of No. 8 conductors to supply not more than two 115 volt circuits.—G.R.

Fixture Raceways

Q. *I understand that there is a new Code change, which permits the branch circuit to be run through one fixture to another, even though the fixtures are not connected end to end to form a continuous raceway. Is this correct?*—W.Q.

A. Section 4150 of the 1951 Code will permit the conductors of a single circuit to be run through a fixture, as a raceway, to another fixture, provided the fixtures are connected together by approved wiring methods. This new Code provision will permit the branch circuit to enter a fixture, continue through same to other fixtures, which may be separated by considerable distances. I would consult the local inspection authority before applying this new Code provision.—B.A.McD.

Thermal Devices For Overcurrent Protection

Q. *Section 2404 of the Code prohibits the use of thermal cutouts and relays to be used for the protection of conductors against overcurrent due to short circuits except the*

conductors of motor circuits, which are also protected in accord with Section 4330. Is the Bussman "Fustat" considered a thermal device and does this rule cover this device?—M.B.

A. The Bussman "Fustat" is a combination overcurrent device which gives both branch circuit protection as well as motor running protection. It has a fuse link which gives the required short circuit protection and it also contains a heater element which protects a motor from gradual overloads. Since such a combination device is recognized by Section 4344 of the Code, this device may be used either as an ordinary fuse or as a thermal cutout for the protection of a motor simultaneously. This device, therefore, does not violate any of the requirements of Section 2404. —B.A.McD.

Service Entrance Conductors

Q. *A two-story mercantile building is now being erected in our city which will have four store occupancies on first floor with a number of apartments on the second floor. In the wiring for this building, must we provide a service room somewhere in the building which will be accessible to all occupants of this building?*—S.B.

A. No, the Code now states under Section 2351 b. that in a multiple occupancy building each occupant shall have access to his disconnecting means, but where a building does not exceed two stories in height, service conductors may be run to each occupancy in accordance with Section 2301 b. and each such service may not have more than six subdivisions as is provided for individual services under Section 2351 a. Upon referring back to Section 2301 b., you will note that buildings of multiple occupancy may have two or more separate sets of service entrance conductors which are tapped from one service drop, or two or more sub-sets of service entrance conductors may be tapped from a single set of main service conductors. In other words, each individual occupant on the ground floor of this building may have wholly within his occupancy service for his portion of the building. Then for the apartments on second floor, you may either provide a common accessible point from which all apartments may be served or you may provide, as for the ground floor, individual services within each apartment. While it does not apply to the building in question, we wish to call

your attention to the point that where a building exceeds two stories in height and where those stories above the second floor are used for more than a single tenant, the provisions of the Code will require a common accessible point for service.—C.R.

Motor Branch Circuit Protection

Q. *One of our major cities where the electrical code was out of print, we were advised to follow the latest N.E.C. except for wire sizes, in which case the 1940 code would apply.*

For the purpose of this question, let us assume a pull type pipe power panel with 220 volts, three phase branch circuit units, feeding several 30 hp, 10 hp and 5 hp squirrel cage motors with combination starters as controllers. We sized our branches for each motor according to the code as follows:

30 hp—78 A. F.L. from 400 A. unit —#2 RH wire (115 A.—1940 code)

10 hp—27 A. F.L. from 100 A. unit —#8 RH wire (40 A.—1940 code)

5 hp—15 A. F.L. from 60 A. unit —#12 RG wire (27 A.—1940 code)

After completion of the work, the electrical contractor advised that he was required to connect the branches as follows:

30 hp—78 A. F.L. from 200 A. unit —wire size as above.

10 hp—27 A. F.L. from 60 A. unit —wire size as above.

5 hp—15 A. F.L. from 30 A. unit —wire size as above. All this to protect the branch feeder conductors.

Since each motor is protected by its controller, any short in the line between branch fuse and controller would draw so heavy a current that the fuses at the panelboard would immediately open the circuit, even though the rating is as high as three times the conductor carrying capacity (Abbott 1509). The reduction in branch circuit protection may cause unnecessary interruption and increase of conductor sizes would serve no useful purpose and would be wasteful.

Why does an interpretation of the Code after installation, supersede sound design based on outlined recommendations?—I.K.

A. It would seem that our questioner is correct in all but his final paragraph, which is his question.

As for that last paragraph, interpretations should always be obtained before installation rather than after. In this case, however, the interpretation does not appear to be in line with column 7 with Table 20 of the Code.

There we find that for a 78 amp. motor the maximum size protective device for the motor branch circuit would be rated at 250 amps. which would require a 400 amp. unit and that likewise for a 27 amp. motor, a motor circuit fuse of 90 amps. could be used and this would require a 100 amp. unit and for the 15 amp. motor, a 45 amp. fuse in a 60 amp. unit, would be right.

Our questioner is correct in that the motor branch circuit is protected only against short circuits as that is all that would normally occur in a motor branch circuit as overloads only come from the motor itself and that is protected against in the controller.

Anyway, why not use time lag fuses selected at the proper ratings as shown in column 5 of Table 20 and have all the protection needed?—F.N.M.S.

Bushings

Q. *We have had a couple of fires in our town caused by a breakdown of the insulation on conductors where they leave raceways and enter cabinets or boxes. Would it not be advisable to require the use of insulating bushings on all larger conductors to guard against the abrasion caused by contraction and expansion or building vibration or whatever else causes the fraying of the insulation at the points where large conductors leave raceways?*—G.W.W.

A. Yes, you are correct in your assumption that insulating types of bushings should be used. In fact the Code now under the new edition requires the use of an insulating type bushing for conductors No. 4 or larger wherever they enter a raceway in a cabinet, pull box, junction box or gallery gutter. If you will remember the old section of the Code used to state that where the conductor was deflected more than 30 degrees, such a bushing was required. Now, under Section 3736 b, this bushing is required regardless of whether there is any deflection or not. It further states that where conduit bushings are constructed wholly of insulating material a locknut shall be provided both inside and outside the enclosure to which the conduit is attached.—G.R.

Conduit Fill

Q. *I would appreciate your advice concerning the "percent area of conduit fill" that would be used for one round three-conductor lead*

covered cable. I believe the answer should be either 55% or 40%, but am not sure which.—A.H.S.

A. Reference should be made to the last column in Table 16, Chapter 10 of the N.E.C.

There will be found the area of a single lead covered cable made up of three conductors. There it will be found that the area of the cable should not exceed 55% of the conduit as shown in the first column under "Lead Covered" in Table 12.—F.N.M.S.

Conductors Operating At More Than 150 Volts To Ground

Q. *On a 3 phase, 4 wire, delta connected service, the voltage to ground is 110 volts. On all of my three phase power circuits however the inspector made me use double locknuts or grounding bushings. What rule covers this requirement?*—W.W.

A. Section 2574 of the Code requires any conduit system, containing a conductor operating at more than 150 volts to ground, be provided with additional fittings which will provide a more secure method of electrical continuity than that obtained by the one locknut and bushing provision. Several methods are recognized and are definitely covered by Sections 2572 and 2574. In the case covered by your question, two of the phase conductors operate at 110 volts

CHIEF ELECTRICIAN H. A. Krogstad (left), Filer & Stowell Co., Milwaukee, checks design of an inspection lamp with Walter M. Braun of the Daniel Woodhead Co., at recent Milwaukee EME show.

to ground. The third conductor, however, operates at about 187 volts to ground. Since this exceeds 150 volts to ground, the inspector is correct in his criticism.—B.A.McD.

Q. *If a U.L. approved surface type pan fixture is mounted directly against an outlet box, is it permissible to pull No. 14 type R wire to that box to supply such a fixture?* —R.E.A.

A. It will depend entirely upon the maximum temperature which this fixture will attain as Section 4179 of the Code states that conductors having insulation suitable for the temperatures encountered shall be used and inasmuch as it is possible to have an approved fixture attain a temperature above 140 degrees F. it becomes an individual problem on the part of the contractor to determine the type of insulated conductor he shall use for the circuit supplying each different type of fixture. As an illustration, fixtures approved for use in a building of fire-resistive construction may operate at temperatures not to exceed 302 degrees F. while fixtures approved for use where they may be installed adjacent to combustible material are limited to temperatures not to exceed 194 degrees F. Hence you can see the necessity of utilizing special insulations whenever circuit conductors are subject to temperatures such as this. In fact, it is not uncommon today to have installations where special heat resistant types of fixture wire must be run through a suitable metal raceway extending not more than six feet from the fixture to an outlet box where ordinary building wire terminates.—G.R.

Using Socket For Cord Attachment

Q. *What rule in the Code says I can't install a ceiling outlet consisting of a cord and porcelain socket and then plug a portable device, such as a flat iron, into the socket?* —J.W.

A. Section 4156 of the Code says that lamp holders of the screw shell type, shall be installed as lampholders only. This means that the lampholder cannot be used as you outline in your question. You could install a receptacle outlet at the end of the cord but if you are planning to serve a 1000 watt flat iron, be sure the cord has sufficient carrying capacity. —B.A.McD.

REMOTE CONTROL CIRCUIT SAFETY

FROM PAGE 79

limit, the fulfilling of our recommendation requires the mounting of a counterbalance on the arm, which would surely open the circuit if the float fell off.

Where the upper and lower limits of float-travel span a distance of several feet, the float is suspended on a chain or cable with a counterbalance weight on the other end. The chain travels over sheaves and through eyes or loops at each end of the switch rocker arm. Stops are mounted on the chain to trip the arm at extremes of travel. These stops should not be simple collars that depend on set screws. A better choice would be split balls with through-bolts.

The secondary defense for this type of switch might be some tripping device coupled in the circuit and mounted below the counterbalance weight, which would act to open the circuit if the weight fell on it.

We come now to thermostats, which in industrial use nearly always control destructive forces. They are usually backed up by limit controls connected in the control circuit or by other suitable means. In an electrically heated furnace, salt bath, or soft-metals-melting operation, the limit control could consist of a simple fusible link which can open the circuit.

In a fuel fired heater there is always some automatic shutoff device placed directly in the pilot flame, in addition to the safety limit-control. This pilot control may be thermomechanical, thermoelectric, or it may trigger an electronic circuit and depend on conduction of the flame. One such circuit even depends on the flame to rectify alternating current, permitting only pulses in one direction.

The secondary defense for a thermostat, and for the other control devices we have discussed, may of course include warning lights, horns, etc. The limit control for an air heated or steam heated oven or tank would usually be another device on the order of the thermostat. Care must be used in placing of thermostats and limit controls so that they don't give false action. As a simple example: in a residence, the thermostat must be placed as far as possible from doors, windows, fireplaces, and other heating equipment.

The photoelectric relay circuit comes in many arrangements and is used for countless different tasks but the principle is always the same. The con-

use one of these 6 Reduced Voltage Starters

To prevent damage to many machines or to materials in process, squirrel cage motors often need gradual acceleration. For such applications, one of these reduced voltage starters will provide the desired speed-torque control.

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MANUAL—TRANSFORMER TYPE

Manual transformer type starter up to 125 hp, 220 v; 250 hp, 600 v max. Air break or oil immersed contacts. Automatic reset overload relays. Time delay mechanism determines proper time interval for manual switch-over of hand lever.

BULLETIN 646

MANUAL—COMPRESSION TYPE

Manual compression resistance starter up to 50 hp, 220-600 v max. Graphite discs in the insulated tubes are compressed with the hand lever for stepless speed control. Ideal starters for chain or belt drives. Overload relay protection.

BULLETIN 640

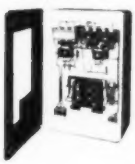
AUTOMATIC—3 STEP RESISTANCE

Automatic resistance starter up to 400 hp, 220-600 v max. Accelerates squirrel cage motors in 3 steps. Resistors easily adjusted for ideal starting of motors on power networks. For more than 3-point control, use Bulletin 742 starter, below.

BULLETIN 741

AUTOMATIC—TRANSFORMER TYPE

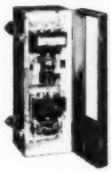
Automatic reduced voltage starter up to 300 hp, 600 v max. An accurate timing relay controls the accelerating time. Operator touches start button—the starter does the rest. Available in standard, watertight, and dust-tight enclosures.



BULLETIN 746

AUTOMATIC—2 STEP COMPRESSION

Automatic resistance starter with preset adjustable graphite resistors up to 250 hp, 220-600 v max. Push button closes starting circuit through resistors. Later, timing relay closes running contactor and cuts out the starting resistors.



BULLETIN 740

AUTOMATIC—STEPLESS TYPE

Fully automatic resistance starter with solenoid controlled graphite disc resistors rated up to 500 hp, 220-600 v max. Stepless control of current and speed. Acceleration adjustable to avoid lamp flicker. Overload relay protection.

BULLETIN 742

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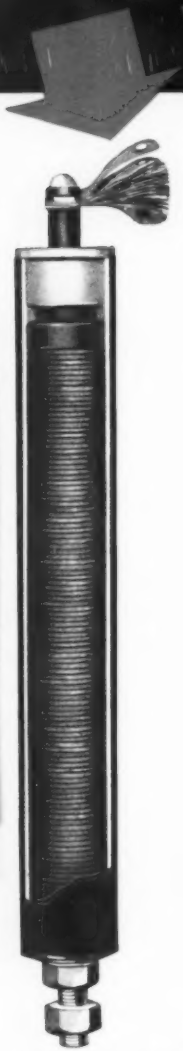

Cutaway view of Allen-Bradley graphite resistor tube showing discs, insulating lining, and the pressure terminal.

With these Allen-Bradley compression resistance starters you can start squirrel cage motors with such velvet smoothness that there is no voltage dip . . . no lamp flicker. The secret of this stepless acceleration lies in the smooth control of the Allen-Bradley graphite compression resistors which are shown below.

BULLETIN 640 MANUAL
Stepless Resistance Starter

The motor current passes through the graphite disc resistors. Compressing them with the hand lever reduces the starting resistance steplessly until it is shunted automatically by the running contactor.

Bulletin 640 manual starters have a hand lever for manually compressing the resistors. At maximum speed position, a magnetic contactor automatically connects the motor to full voltage.

BULLETINS 740 & 741 AUTOMATIC
2 and 3 Step Resistance Starters

In these two resistance starters the adjustable resistors are arranged in 2 or 3 steps. Each step is cut out, successively, by timing relays. These starters can be easily adjusted for equal current inrush per step.

Bulletin 740-741 starters are rugged, automatic starters.

BULLETIN 742 AUTOMATIC
Stepless Resistance Starter

In this starter, compression of the graphite discs is done automatically by a solenoid mechanism. Absolutely velvet smooth acceleration is obtained. No other starters provide similar stepless control.

Bulletin 742 resistance starters prevent lamp flicker on network systems. They provide automatic stepless starting for machines and processes which are easily damaged by sudden starting.

BULLETIN 646 TRANSFORMER TYPE STARTER

For loads with high starting friction, requiring sudden applications of power, use the Bulletin 646 manual or the Bulletin 746 automatic transformer type starters.

Write for Bulletins to Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin

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trolling factor must interrupt or diminish the direct or reflected application of a beam of light upon the photoelectric tube. Failure of the light beam can be insured against by doubling the lamps (if the lumen factor is not critical) or a relay can be placed in series with the lamp to warn of filament burnout.

The phototube always controls the flow of current to a controlled solenoid or device, or it triggers a relay which controls the final equipment. The control current will be received directly from or coupled to the plate circuit of the phototube, or from that of a final amplifying tube. Thus, our insuring against failure may consist of paralleling the tube which supplies control current; or a small signal relay can be placed in series with the plate circuit or in parallel with the main control relay. If tubes are paralleled, a separate signal relay could be inserted in the plate circuit of each tube. Such a relay is used to indicate failure or diminishing of plate current or excessive current.

In summary, wherever an electric coil or solenoid is used to control some operation, the grounded side or phase wire of the electrical supply line must be connected to one side of the coil by the most direct route possible. By this precaution, any fault ground occurring in the control circuit will not cause a flow of current through the coil and give false operation. This aspect was covered more thoroughly in the previous article on control circuits.

It should be pointed out, also, that the approval or labeling of control devices by some agency (such as Underwriter's Laboratories, Inc.) is no assurance of their correct operation in conjunction with other devices or equipment. Let us set up an imaginary sequence of events to illustrate. An automatic pumping station is built around a large hydro-pneumatic water pressure tank. The line pressure controls a supply pump by a pressure switch and the magnetic motor controller. A float mechanism, within the tank, controls the operation of an air compressor which maintains the proportion of air to water within the tank.

Due to lack of damping of the gage line to the pressure switch, it starts a resonant tripping action (as explained earlier in this article), stopping and immediately restarting the pump till its controller freezes in the running position. The pump continues to run, increases the pressure, and compresses the air till the air compressor starts; adding its pressure to the affair.

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Industrial Electrification

Service Hints For Single Phase Motors

Understanding of characteristics and construction of repulsion induction and repulsion-start induction single-phase motors helps determine and correct causes preventing motor from carrying rated load.

By August W. Bohn
Wagner Electric Corporation
Saint Louis, Mo.

CONSTRUCTION operation of the repulsion induction motor is quite similar to that of a straight repulsion motor, with brushes riding the commutator and carrying current at all times. To prevent motors from "running away" at high speed, the squirrel-cage principle is used, placed in rotor slots below windings. This squirrel-cage creates a restraining force as a rotor passes synchronous speed. Full load speed is determined by brush settings, generally 30 electrical degrees from the live neutral. Such motors are ideal for heavy prolonged starting periods, such as would be the case in air compressor service where congealed oil and frequent low voltage is encountered. Where constant running speed is desirable, such as for refrigeration duty, repulsion induction motors are not recommended.

These motors are really a combination of two types. During starting periods, up to about 80 percent of synchronous speed, motors are fundamentally repulsion type. After the governor mechanism has short circuited rotor windings to produce what is essentially a squirrel-cage rotor, the motor, operating at constant speed, is of the induction type.

Repulsion-start induction motors are constructed with both horizontal and vertical commutators. In the case of the horizontal commutator, brushes ride continuously but carry current only when the motor is starting, before short circuiting of the rotor. Ends of commutator segments are shorted by a bronze coil spring, a bronze disc or a circle of separate copper segments. With vertical commutators, brushes ride only during the starting cycle and they are lifted by the governor mechanism when the rotor is shorted.

Two devices are used for lifting brushes. The first involves a rocker arm fixed to the front endplate. Cams, extending from the brush holder into the spring barrel chamber in the commutator bore, are engaged by a knock-off ring on the end of the barrel when governor weights move the short circuit weights into position. With this construction, brush life is reduced when end play increases the distance between brush holder and commutator face for, under this condition, the useful length of the brush is materially reduced.

The second device for lifting the brushes involves a rocker arm linked to the spring barrel. Here the complete rocker arm, with the brushes, moves away from the commutator when short circuiting weights are moved into position. Since end play has no effect on the distance between brush holder and commutator under this arrangement, longer brush life generally results.

In operating principle, all repulsion-start induction motors are similar, starting and pulling up the load as repulsion motors then, when between 75 and 80 percent of synchronous speed has been reached, running with the load as induction motors.

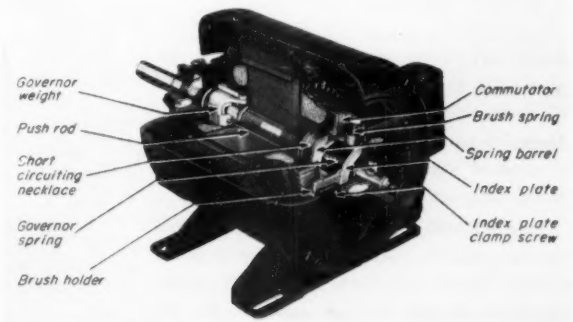
The ability to start and pull up the load to speed is affected by both operating conditions (such as low voltage, excessive load, belt tightness) and motor defects (such as tight bearings, corroded commutator, improper brush settings, lack of proper brush pressure, low grade of brush, poor adjustment of governor weights, or short circuits in the rotor).

Service Hints

Test equipment, for determining the causes for motors failing to pull up, includes a hand tachometer, voltmeter and dynamometer or other load-testing equipment.

On new installations, overloads or low voltage may be the cause of the trouble. Low voltage, reducing the motor torque, can be due to undersized wiring or excessive distance to the main feeder. Normal load should be carried by the motor if the voltage is within 10% of that specified on the nameplate.

Checks should also be made for (1) proper tension and alignment of belts,



CUTAWAY VIEW of typical ½-hp. repulsion-start induction motor shows operation of short circuiting and brush lifting mechanism. Position is that existing on starting.

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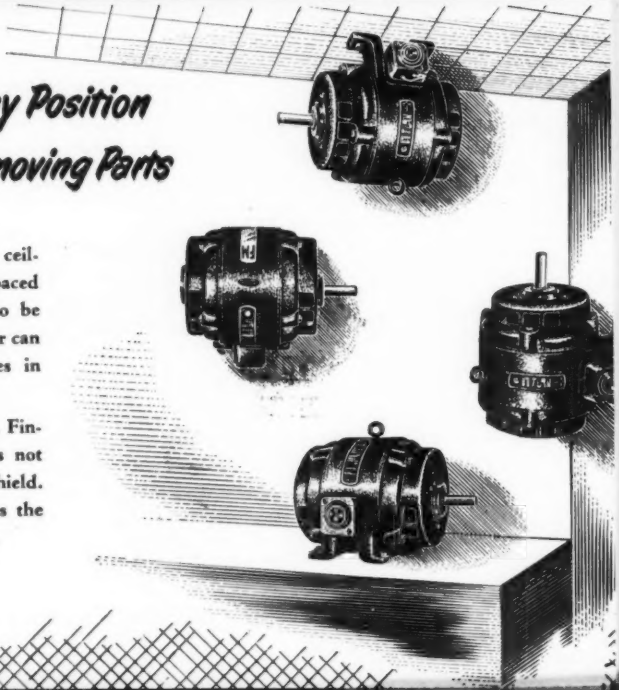

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TYPICAL ROTOR of fractional-horsepower repulsion-start induction motor, with brush holder and short-circuiting mechanism removed with the exception of push rods and governor weights. In assembling, place barrel spring (1) in bore of commutator, flat side against push rods and free ends of short-circuiting weights up. Set rocker arm and brush holder assembly (2) against spring barrel and place spring barrel assembly (3) in counter bore of spring barrel with a small amount of grease rubbed on both sides of spring barrel extension washer. Slip governor spring (4) over shaft against spring barrel extension place governor spring retainer (5) flat side down against spring, and press down so that spring retainer (6) can be inserted in groove of shaft. When pressure on spring is released, retainer washer is held in place by flange of retainer. Spacing washer (7) is sometimes used between governor spring and retainer to make spring stronger, thus raising throw-out speed of governor weights. Slide washers (8) over bearing surface of shaft so they will rest against shoulder in the following order: thrust cage with resilient washer, steel shim washers as required, and bakelite washer. Rotor is now ready for assembling in motor.

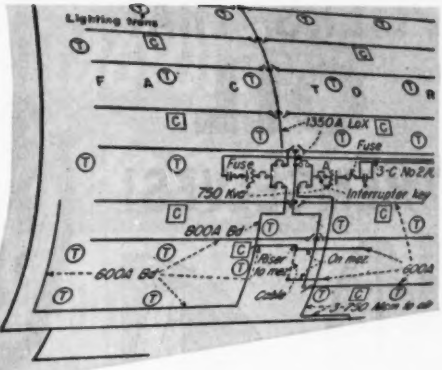
(2) ease of rotor rotation, (3) the setting of brushes, (4) rotor short circuits, (5) commutator corrosion and (6) the speed attained by the running motor. Speed can often be increased by moving brushes backwards or forwards a slight amount. Where exact speed is not too important a factor, the load can be reduced on the motor by installing a smaller pulley or, if speed must be maintained and the fault cannot be traced, it may be necessary to install a motor of greater capacity.

Where motors have rendered previous satisfactory service, it is well to check the voltage and lightly sand the commutation. Then (1) check the rotor for shorts, (2) make sure that the brushes are long enough to establish a positive contact, (3) check the tension of the brush springs, (4) test the speed, (5) replace worn parts of the governor and short-circuiting mechanism if governor weights fail to operate when rotors are turning at 1450 rpm., and (6) clean the motor of all dirt and grease.

Checking the rotor of a repulsion-start induction motor can be accomplished without removing it. Brushes are either removed from their holders or are insulated from the commutator by a piece of sandpaper placed beneath each brush, with the paper side in contact with the commutator. Full voltage is then applied to the stator and, if the rotor can be revolved freely by hand, no shorts are present. If there is a short circuit, the rotor will hang in several positions. When the rotor hangs, it can be held in a hung position until a hot spot appears in the rotor winding, indicating the shorted coil. The winding may be either in the winding or between bars of the commutator.

Brush Setting

Brushes are set at the factory in accordance with individual rotors and stators. These settings can be checked by examining the running marks that have been placed on the commutator end plate. Matching chisel marks on the endplate rim and on the motor frame, or a positioning dowel pin will insure the exact positioning of the endplate in relation to the stator. When either a stator or rotor is rewound or replaced, brushes must be reset in accordance with the new units, and new running marks placed on endplate.



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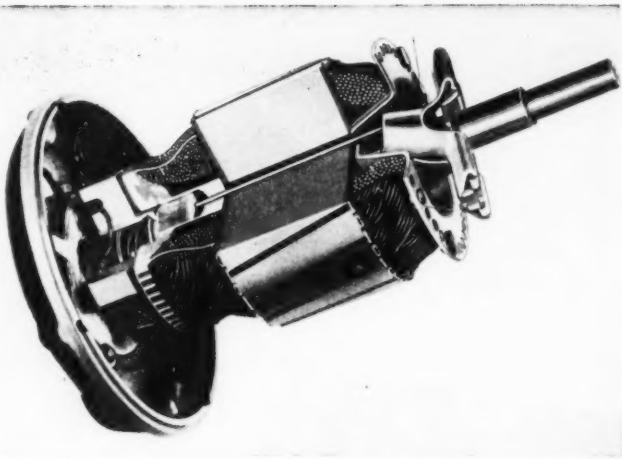

CUTAWAY ROTOR shows position of governor mechanism during starting period. Brush holder is held in position by arm on index plate. When motor is running, brushes should clear commutator and brush holder should be loose on endplate.

Locating the correct brush position can be accomplished by locating the live neutral position under full voltage conditions. The live neutral can be recognized by shifting the brushes until a slight movement of the brushes in either direction will cause rotor rotation. Live neutral occurs when brushes are set between wound stator poles. The other neutral—referred to as the lazy neutral—occurs when brushes are located in the middle of the wound stator pole. This neutral is quite wide and brushes can be moved some distance without causing rotor rotation.

Brush Setting

Brushes can be set by two different methods after the live neutral has been established, so that shops with or without load-testing facilities can accurately perform this operation.

Where load-testing equipment is not available, brushes are set on the live neutral, the brush holder locking screw is tightened and the power is turned off. The rotor is then turned until one of the commutator segments lines up with one side of a brush. Holding the rotor stationary, the brush holder is loosened and moved approximately 1½ segments in the direction which will give the desired rotation. The brush holder is tightened in this position although, if the motor does not pull up quickly under load when it is placed back in actual service, the brushes can again be shifted slightly for a final adjustment.

If it is possible to perform a brake test, brushes are set for the desired rotation and then, under full voltage conditions, load is applied until the brushes will not come off the commutator in any position. Brushes are shifted until highest speed is attained and are locked in that position.

Brush life is determined by the length of time brushes carry current. Under normal conditions, brushes will carry current for about a second on starting and should last for years. Rapid wear indicates that brushes are carrying current too long, the cause of which may be (1) low voltage, (2) incorrect brush settings, (3) excessive load, (4) dirty or pitted commutator, (5) faulty governor operation, (6) weak brush springs, (7) brushes sticking in the holder, or (8) a defective short-circuit mechanism. When replacing brushes, it is recommended that the same grade as those originally furnished by the manufacturer be installed.

Since repulsion-start induction rotors must be carefully assembled, special attention is recommended when checking the commutator bore, the adjustment of the governor mechanism and the wear of the brushes.

To insure good contact and proper operation of short-circuiting and governor weights, the bore should be smooth, for pitting or tool marks will cause short-circuit weights to drag on the rough surface, and governor weights will not operate at the designated speeds. When this speed is too high, the motor will not pull its load or remove the brushes from the commutator. Poor contact between weights and commutator will cause the rotor to act as a high resistance unit, reducing the running speed and causing excessive noise while running.

Both governor weights must be

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COMMODORE

WAKEFIELD CEILING

under tension when properly adjusted, so, if one weight is not held tightly, the push rod of the opposite weight should be shortened until both weights are under equal tension. With the governor weights in the out position, the face of the spring barrel should line up with the commutator face. If the barrel is further out than this, push rods may be too long and should be shortened. Wear will increase the governor weight travel. In such a case, the felt or rubber cushions, against which the weights stop when they fly out, should be replaced. Metal stops can be installed instead of the cushions if the resulting clicking noise will not be objectionable. It is also well to check the governor and its support for alignment, for it is possible that either part has been bent.

Brushes and brush holders of repulsion-start induction motors should have long lives, although faster wear can be the result of low voltage, excessive load, dry bearings, incorrect brush settings, a rough commutator, poor contact of brush and commutator, a rough or oily bore or by a shorted rotor. All of these conditions should be checked carefully.

Vertical Face Commutator

Many motors use a rotor with a vertical-face commutator with a recess, bored concentric with the rotor shaft, into which a sleeve called a spring barrel is fitted so that it can slide freely on the shaft. Weights for short-circuiting purposes are mounted in a groove on the outer surface of the spring barrel.

During the starting period, short-circuiting weights and ring are in contact, insulated from other parts of the rotor. This insulation is necessary to prevent shaft currents destroying bearings and shafts.

Weights are of copper, punched with a relief so that, while in the running position, they will rest securely and firmly against the commutator segments and the short-circuiting ring and completely short circuit the rotor. These weights are strung on a piece of copper wire and this necklace is wrapped around the spring barrel with the wire end down. While the motor is running, centrifugal force presses these weights against the com segments and short-circuiting ring.

On repulsion-start induction motors, the brush holder is linked to the spring barrel, and moves with it so that brushes are lifted from the commutator when the rotor is shorted. Parts are held in position by a governor spring until the speed is such that centrifugal force overcomes this spring pressure.

"MAN-MADE DAYLIGHT"

These fixtures in Otis Elevator Company's New York offices are "PBM" luminous direct-indirect units manufactured by Day-Brite Lighting, Inc., St. Louis, Mo. They consist of fluorescent tubes totally enclosed in PLEXIGLAS cylinders. White translucent bottom sections and clear transparent top sections diffuse light downward and permit it to be reflected from ceiling. Fully enclosed design protects light sources from dust accumulation—insures long-time maintenance of high lighting level with occasional easy cleaning. Distributor: Graybar Electric Co., New York City; Electrical Contractor: H. C. Ruschmeyer & Son, New York City; Architect: Carl J. Kroepel, New York City.

PLEXIGLAS Lighting...

Cuts Shadows without Substituting Glare

When shadows get caught on the point of a draftsman's pencil—or glare gets in his eyes—plans are bound to suffer. Otis Elevator Company ended these frequent drafting-room annoyances with a new type of PLEXIGLAS lighting fixture. Now there's no trouble with shadows or glare on the drafting tables.

In offices, plants, schools, public buildings, and homes, white translucent PLEXIGLAS leads to good lighting. It gives high level illumination with low source brightness. Result:—Full, pleasant lighting that lets you see without eyestrain.

PLEXIGLAS is easy to erect and maintain, in luminous ceiling installations, coffer lighting, and individual fixtures. Light weight and shatter-resistance mean safety overhead, and low-cost maintenance in the bargain. Full information on PLEXIGLAS acrylic plastic for lighting is yours without obligation.

CHEMICALS FOR INDUSTRY

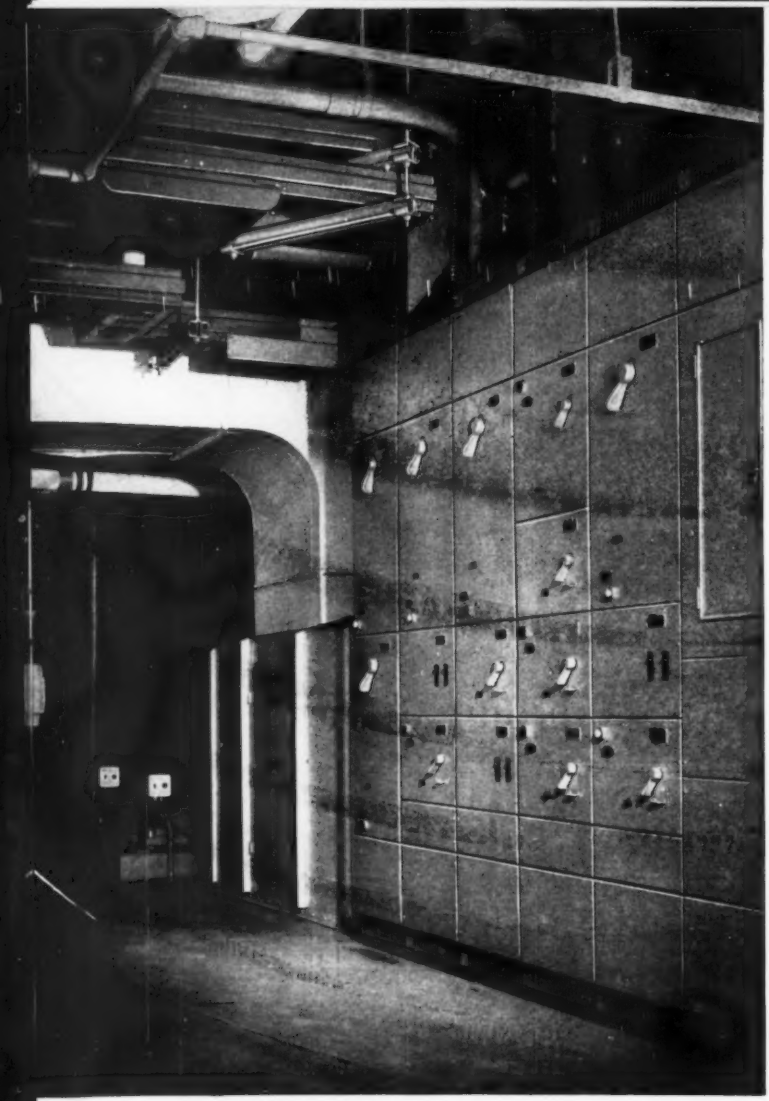
• A steadily increasing percentage of PLEXIGLAS production, now at record levels, is required for the defense mobilization program. The supply available for civilian applications is limited.

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries. Canadian Distributor: Crystal Glass & Plastics, Ltd., 54 Duke Street, Toronto, Ontario, Canada.*

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries



NEW CONTROL CENTER FINDS READY MARKET

where requirements may change any day

AIR CONDITIONING and miscellaneous motor controls in U.N. Secretariat Building are operated through this Trumbull CENTR-A-POWER Control Center. The control center is fed from the Trumbull FLEX-A-POWER LVD busway distribution system running throughout the building.

Buyers are asking this question about any new equipment under consideration: can it be adapted to conditions now unforeseen?

That is why you'll find yourself welcome when you talk about the convertibility – as well as the convenience, safety and attractive appearance – of new Trumbull CENTR-A-POWER Control Center.

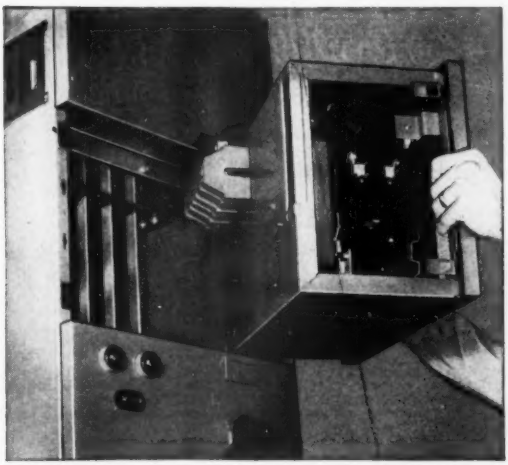
Standardized starter-and-disconnect units are grouped in pre-fabricated, rigid steel troughs, in any arrangement. Any number of troughs can be set up in a variety of formations: back-to-back, "U", "L", etc. The control units, called CENTR-A-PLUGS, which are stabbed into silver-plated vertical bus bars, are interchangeable from one trough to another.

Trumbull's CENTR-A-POWER Control Center is a companion to the recently announced CENTR-A-POWER switchboard, and is another in the series of new Trumbull developments for greater economy, safety, and efficiency in electrical control and distribution.

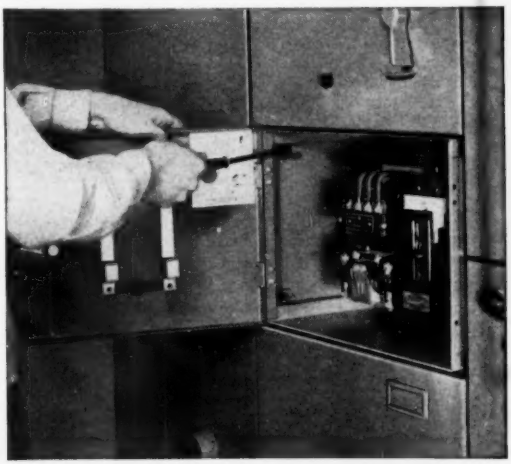
Bulletins are available for your interested customers. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

LOW-COST INSTALLATION results from standardization of components. From the complete selection of troughs and control units, the exact combination can be made up to meet any requirements. Floor space is saved by the compact all-front-wired trough design. Yet the ample gutter saves time by giving easy access to wiring.

EASY TROUGH ADDITION recommends CENTR-A-POWER Control Centers for applications where needs may change from time to time. Arrangements of both troughs and controls can be easily altered or added to, and even bus capacity can be increased as conditions require without change in insulators or steelwork.



SIDE-VENTILATED CENTR-A-PLUG is stabbed in from front. Each unit contains a starter-and-disconnect unit, which may be either Trumbull's new HCI high-capacity interrupter safety switch or a Trumbull AT circuit breaker. Ventilated side construction, together with trough vents top and bottom, keep controls uniformly cool.



SAFE, EASY SERVICING is provided by the interlock which requires the disconnect handle of the deadfront CENTR-A-PLUG to be moved to OFF position before it can be opened . . . and by the quick-clip method of attaching the control unit to the trough which eliminates the nuisance of screws, nuts, and loose parts.

TRUMBULL (T) ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY

PLAINVILLE, CONN.

Better LIGHT... means better "sight"!

Model VL-440

The "Officer"—Leader's finest fluorescent fixture for all commercial interiors where beauty of appearance is as necessary as lighting efficiency. Available for 2, 3, or 4 40-watt lamps (VL-240, VL-340, VL-440) also for Slimline lamps in lengths from 48" (VL-448) to 96" (NHC-280, NHC-380, NHC-480).

The "Stratoliner"—Highly efficient, heavy-duty, all-steel industrial fixture. Removable end caps and turret-type sockets for easy servicing. Open and closed end models for 2 or 3 40-watt lamps (IUO-240, IUO-340) or 2 100-watt lamps (IUO-2-100).

Model IUO-240

Employees see more . . . do more with LEADER fine fluorescent fixtures

Large amounts of light without confusing shadows or glare that interferes with sight help everyone get more done, every day, in a well-planned, modern business. Office workers and plant personnel alike benefit from the right kind of light at the right place, at the right time . . . and production is stepped up all along the line.

Leader fluorescent fixtures, always a step ahead in design and engineering, offer you the widest possible selection of fine luminaires to choose from . . . for the right *kind* of installation in any situation. Leader *quality* is your assurance of satisfactory performance. To get acquainted with the Leader line, write for catalog, today!

Leader

Sold and installed by the better electrical dealers and contractors

America's No. 1 Lighting Equipment Manufacturer

LEADER ELECTRIC COMPANY • 3500 N. Kedzie Avenue • Chicago 18, Ill.

Leader Electric—Western: 800 One Hundredth Avenue • Oakland 3, California

Campbell-Leader, Ltd.: Brantford, Ontario, Canada

Modern Lighting

CONSTRUCTION was carried on above the heads of shoppers, with workmen using numerous aluminum sectional scaffolds. The arched roof allowed ample space above the ceiling for maintenance cat-walks. The widely-spaced 2-lamp fixtures shown above were replaced by continuous rows of channels on 32-inch centers.

INSTALLED CEILING covers 8000 square feet and provides 65 footcandles of illumination for general shopping. Meat counters and delicatessen, lighted by soft white lamps, have 53-fc levels. Louver cells measure 2-by-2-by-2-inches and are constructed in 4-foot square panels of baked enameled aluminum.

Louverall Lighting For Super Market

Construction with "business going on as usual" is often annoying to sales people and customers alike, so it is interesting to hear that a west-coast super market actually stepped up their volume of sales by making a relighting installation the theme of a publicity stunt. The installation was for Max Garth's Best Food Market in Los Angeles, and the publicity idea offered prizes to the customers whose guesses came close to the actual number of individual cells in the new louverall ceiling. This guessing contest paid dividends in attracting new customers to the store. Incidentally, the correct number of square cells was 236,123.

The installation attracted considerable attention from other market owners as well, for it marked a new conception of market environment, combining visual, acoustical and ventilation advantages in a single installation.

Louver panels are 4 feet square with aluminum 2-by-2-by-2-inch cells providing a 45-degree shielding angle. Cells are finished with baked enamel. The area covered measures 97- by 87-feet, louver panels are suspended 16 feet from the floor, and single lamp rows of continuous channels are spaced 30 inches above the ceiling at 32-inch intervals. In all, there are 342 T-12 eight-foot lamps and 27 six-foot lamps, operating at 430 milliamps. Color of lamps is 4500-degrees Kelvin except in the areas over the meat counters and delicatessen, where the lamps are soft white. Maintained levels of illumination on counter tops is 65 footcandles beneath the 4500-degree lamps, and 53 under the soft whites.

Above the ceiling a Lamella-type arched roof, measuring 19 feet above the louvers along the center line and 3 feet at side walls, provide ample space for cat-walks. This permits relamping and maintenance without disturbing the louvered panels or the shoppers.

Installed by electrical contractor John E. Grady, the installation was planned in cooperation with the Illuminating Engineering Unit of the Department of Water and Power, City of Los Angeles. After the installation was completed, maintenance was provided by Floodlight Service, Inc.

Simple Baffles For Small Store

Many lighting men are faced with the problems of stepped ceilings, structural eye-sores and uneven floor plans, making it difficult to recommend a lighting installation which will be functional and attractive at the same time. This was the case when Palman's, located in the Toledo Spitzer Arcade, decided to relight their small store, for the first floor was broken up by protruding enclosures for storage and fitting rooms and, due to this, the ceiling was larger in area than the ground floor. In addition, since the balcony along one side of the store was used as an office for the

WOODEN BAFFLES on widely spaced centers form a false ceiling yet permit ample light and ventilation while blocking the office and storage areas located on the balcony.

THE SCALLOPED CEILING attractively ties the two walls together. General lighting is provided by a continuous fluorescent installation along the store centerline.

owner, a ceiling treatment was desired to provide privacy, block the view of customers, yet permit free air circulation and allow the owner to supervise the sales areas from above.

The answer, suggested by R. M. Taylor, supervisor of the commercial lighting department of the Toledo Edison Company, called for simple baffles to be installed in a transverse position on 1-foot centers. Baffles were constructed of wood, scalloped and painted to form an attractive false ceiling.

General illumination is provided by a continuous row of 2-lamp fixtures suspended down the center of the shop, while highlights for display racks and special sales promoting areas are provided by incandescent spots mounted as desired above the wooden baffles.

The installation was by the Fluorescent Service Company, electrical contractors of Toledo.

Although the installation was a simple one (and cost considerably less than the owner had anticipated), the effect is pleasing.

They Said This About You

SOME "QUOTES" ABOUT

SELLING

From the Report of the Research and Educational Committee of the NECA

"The general practice among electrical contractors is to prepare bids on a given amount of work as shown in a set of plans and specifications prepared by others, regardless of the adequacy of the work. No opportunity is afforded the contractor to utilize his knowledge in the field of installation and design engineering . . ."

"Under such conditions price becomes the only sales factor . . ."

Here's how DAY-BRITE can help you do profitable "CREATIVE SELLING"

The NECA report points out that when price becomes the only sales factor . . .

. . . profits per job dwindle — sometimes disappear altogether.

. . . the quality of the job suffers. Third-rate materials, shoddy workmanship are often used.

. . . and the contractor is always working on a hand-to-mouth basis. He cannot plan ahead. He cannot grow soundly.

The report says, "Creative Selling Offers The Only Solution."

Here Day-Brite can help you. For "creative selling" means going out and selling on the basis of the "extra" you can offer . . . instead of waiting for business to come to you on the basis of price alone.

Day-Brite quality, Day-Brite features give you big extras you can sell on such a basis . . . in addition to your own knowledge of installation and design engineering. And Day-Brite design gives both you and the buyer "hidden bonuses" in the form of lower installation costs, lower maintenance.

Quality can be sold . . . far more profitably than "price." Day-Brite has proved it. Today, Day-Brite sells more fluorescent lighting fixtures than any other single manufacturer.

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis, Mo.

129

NOW, MORE THAN EVER

AMERICA MUST SEE WHAT IT'S DOING

IT'S EASY TO SEE WHEN IT'S

"DECIDEDLY BETTER"

DAY-BRITE

Lighting Fixtures

AVERAGE INTENSITY of 63 footcandles is obtained by slimline lamps and large-cell louvered ceiling in the Los Angeles office of the National Automobile and Casualty Insurance Company.

Large Cell Louvers For Office

A 7500-sq. ft. louvered ceiling is featured in the Los Angeles office of the National Automobile and Casualty Insurance Company, where working areas are illuminated to intensities of 63 footcandles. The cells are 4-inches square and 4-inches deep, made from 0.032-inch aluminum, sprayed white and manufactured in 4-by-4-foot sections by the Carr Company of Oakland. They are suspended 14-feet above the floor and 22-inches beneath continuous rows of lamps mounted on 21-inch centers. Lamps are mounted on continuous single channels equipped with high pf ballasts. The lamps are 96-inch T8 slimlines, 4500-degree white, operated at 200 milliamps.

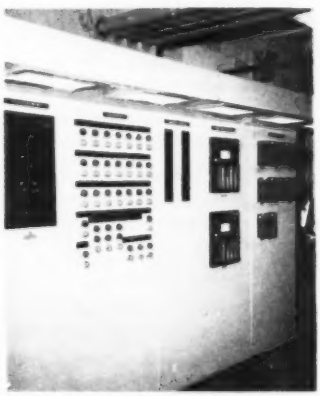
Footcandle readings were taken before as well as after louvered sections were placed in position and it is interesting to note that readings under these two conditions were 79 and 63 respectively. Carpeting in the office is green, while walls are painted light cream and brown. Designed by architect Style Clement with the technical cooperation of the Los Angeles Department of Water and Power, the work was by Newberry Elec. Corp.

Control Panel Has Directional Lenses

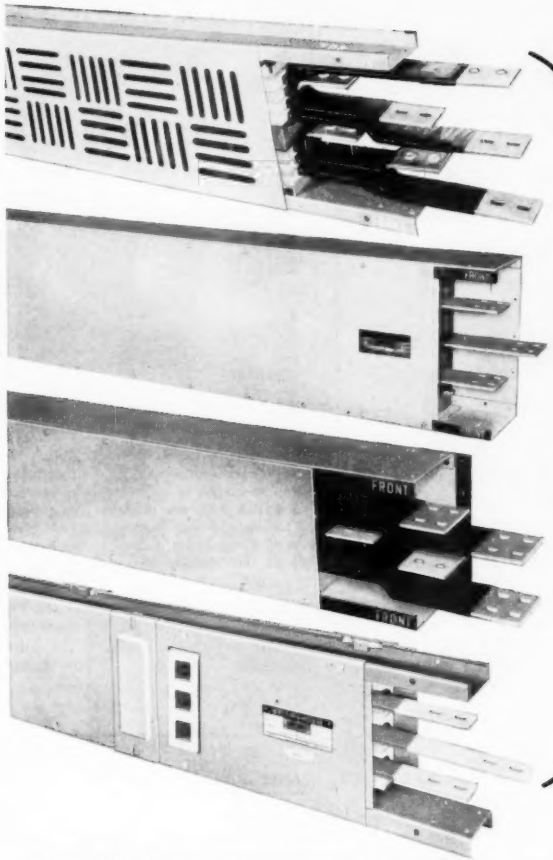
Electrical control of the newly-completed New York Port Authority Bus Terminal is centered in a basement-based watch-engineer's office equipped with a six-section control panel. This panel is powered by a 120-volt single-phase circuit to supply interior and exterior panel lighting, convenience outlets for portable test equipment or trouble lights, annunciator lights and audible alarms.

The lighting control section of the panel includes 40 key-operated switches, two switches for each of 20 remotely-controlled house-lighting panels. Above each of these switches is a pilot light, while back-of-board 6-watt lamps indicate panel numbers and legends.

Canopy lighting is recessed, with lensed plates concealing incandescent lamps. Lenses are directionally ribbed to direct light inwards towards



CONTROL PANEL consists of sections for lighting, motors, annunciators, heating, air-conditioning and plumbing. Legends and switch numbers are back-lighted by 6-watt lamps while panel face is illuminated by incandescent lensed units in the overhead canopy.



BUS DUCT IS FLEXIBLE

FOR EXPANDING POWER DEMANDS...

4 TYPES OF WESTINGHOUSE BUS DUCT HANDLE ALL LOAD REQUIREMENTS, MEET ALL SERVICE CONDITIONS

Up to 5,000 amperes, Westinghouse Bus Duct provides more power per pound of equipment than any system of wireway, cable or conduit.

Westinghouse Duct is quicker and easier to install, too, whether the job is a new layout or a change-over. Prefabricated sections, in any required length, are convenient to handle and mount. No problem, either, with sharp turns or limited space—in any plane—with standardized tees, ells and crossovers.

Westinghouse Duct meets any load requirement or service condition from power source to machine:

1. LOW-IMPEDANCE DUCT . . . Long feeder runs from switchgear to remote areas. (For minimum voltage drop.)
2. WEATHERPROOF DUCT . . . Outside runs from transformer to switchgear.
3. WEATHERPROOF LOW-IMPEDANCE DUCT... For high current-carrying capacity from transformer to switchgear.
4. PLUG-IN DUCT . . . For branch runs; brings power directly to consuming equipment; plug-ins every foot make machine hookups a simple task.

Call your Westinghouse distributor for complete data, or write for Bus Duct Manual B-4272-A, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-30056

DESIGN TESTED AND VERIFIED IN THE Westinghouse HIGH POWER LABORATORY

YOU CAN BE SURE... IF IT'S Westinghouse BUS DUCT

RELAMPING is facilitated by canopy fixture design, for lenses are capable of being raised by a slight upward pressure and slid over the adjacent glass plate. The lips of the fixture prevent lenses from falling, and servicing does not require the loosening of screws.

the panel front, and lenses are in two sections, permitting maintenance men to lift one, slide it above the other lens and clean or relamp the fixture without having to loosen screws.

Just As True Today.

TOO MANY OUTLETS?

Has ever the house been wired that had too many convenience outlets?

That is a question a local association of electrical contractors and dealers has asked us. We do not know. In fact, it is difficult to conceive how a home could be wired too well.

One man told us recently that he had one hundred and twenty-three outlets, not including fixture outlets in his nine-room home., It seemed like a whole lot to us, but the man who was living in the house did not feel he had too many outlets. In fact, he said he knew of a few more places he could use some.

Is it possible to have too many convenience outlets? We would like to hear from our readers on this point.

An editorial from the ELECTRAGIST, April 1926.

MITCHELL

module still America's NO.1 Commercial Lighting

REG U S PAT OFFICE

20% more light!

Yes, MITCHELL MODULE is *still* unequalled for effective light output, unequalled because inch for inch it delivers *more* light per operating dollar than any other louvered commercial fixture. MODULE'S exclusive Polystyrene plastic louver passes 20% MORE LIGHT than conventional metal louvers—saves more lighting dollars in *every* installation.

50,000 ways to get it!

And MITCHELL MODULE is *still* the *only* lighting system that *custom-fits any installation with standard low-cost units.* With just 4 simple, inexpensive "building blocks of light," MODULE creates *unlimited* custom-fitting lighting patterns. Because MODULE units fit together simply (both mechanically and electrically) patterns can be rearranged to meet changing needs—*at minimum cost.*

MODULE'S styling is enduring; stays beautiful, new. No ordinary fixtures can match MODULE—*still* the *only* lighting system that delivers *20% more light* and *custom-fits* any commercial interior at *lowest operating cost.*

only MITCHELL *makes* MODULE

MITCHELL MANUFACTURING COMPANY

2525 N. Clybourn Avenue • Chicago 14, Illinois

In Canada: Mitchell Mfg. Co., Ltd., 11-25 Davies Avenue, Toronto

from everyone's viewpoint...

...mitchell module is today's top lighting buy

See the proof! **Get your copy of *"MODULE IN ACTION"* showing actual installations. Here are selling ideas unlimited for lighting salesmen, contractors, architects and utility representatives. Write for your free copy today.**

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In The News

E. C. Carlson Appointed President of NECA

Erne C. Carlson of Youngstown, Ohio, has been appointed president of the National Electrical Contractors Association. He succeeds Edw. Vanderlinde of Rochester, N. Y., who died March 24.

Mr. Carlson's appointment by the NECA Administrative Committee is for the unexpired term. The regular presidential election will be held at the NECA convention at Washington this October.

A leader in the electrical contracting industry for the last 15 years, Mr. Carlson is widely known for his work in promoting sound industry labor relations. Since 1938 he has served as chairman of the NECA Labor Relations Committee and since 1939 as chairman of the IBEW Employers Section. This Committee has been responsible for promoting the principle of voluntary arbitration in the settlement of all labor disputes in the industry through the Council on Industrial Relations. He also was one of the leaders in the negotiation of the industry-wide employees benefit fund, used to support the workers' pension program.

Mr. Carlson joined NECA in 1928 and has been an active member for 23 years. He was elected to the Executive Committee in 1936 and when NECA was reorganized in 1943 he became a member of the Administrative Committee.

Mr. Carlson has been in the electrical contracting business since 1912 and in 1926 he founded his own company, Carlson Electric, which today specializes in industrial and commercial electrical work and has offices in Youngstown, Pittsburgh and Warren. A charter member of the Penn-Ohio Chapter of NECA, Mr. Carlson has held every office in that organization and now is president.

Illinois Inspectors Hold Annual Meeting

The Illinois Chapter, Western Section, International Association of Electrical Inspectors recently held its 21st annual meeting with 117 present at the Hotel Sherman in Chicago. A two-day agenda covered a range of technical subjects plus a full session on inspector problems; concluded with election of officers for the current year.

Changes appearing in the new 1951 issue of the National Electrical Code were outlined by Robert A. Peterson, IAEI technical assistant. The Code is being printed in Japanese to aid establishment of American wiring standards in that country, Peterson revealed. City rules and regulations are, in effect, instituted by the residents who demand safety regulations, said John J. Mortimer, corporation counsel, City of Chicago. Commissions and departments are then organized to establish and enforce such regulations, he added.

In the near future, Chicago industry will be asked to get on the industrial electrical modernization bandwagon. An outline of a program, sponsored by the Electrical Association, to promote such modernization was given by A. J. McGivern, managing director, Chicago Electric Wholesalers Association and member of the Electric Association Board. He emphasized the need for electrical service and distribution adequacy in industry to assure continuous production and increased efficiency.

Thermoplastic insulated building wire may well become the all-purpose wire of the future, intimated B. J. Mulvey, industrial engineer, wire and cable division, General Electric Co., Bridgeport, Connecticut. Its smaller diameter, bright color coding and price comparable to Type R are definite advantages, he noted. Mulvey added that polyvinyl chloride insulated wire production may reach 60 to 65 percent of all building wire made; expects many manufacturers to stop making Type R and go to thermoplastic cables. Type TW is recognized in the new 1951 NEC in all sizes, he added, noting that there is a high temperature thermoplastic wire approved for appliances. At the conclusion of his talk, Mulvey introduced Geotrol, the new Type TW wire with a nylon jacket for use where insulation resistance to gasoline is desirable.

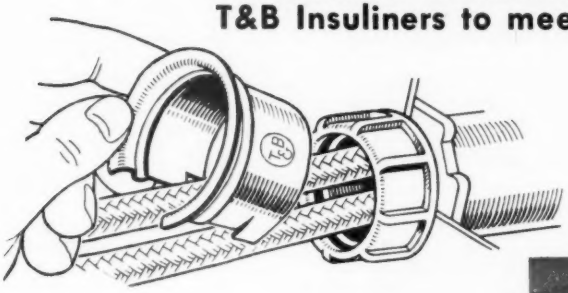
Fred P. Oliver, Union Insulating Company, Parkersburg, W. Va., called open wiring on insulators the most efficient wiring system, noting that conductors in air have 25% more current carrying capacity than when in raceways. Non-metallic sheathed cable with insulated boxes provide an exceptionally safe wiring system, he stated, adding that this method, using neoprene sheathed cable, is now used in trailer coach wiring.

Wiring of trailer coaches and trailer camps was discussed at some length during the floor session on inspector problems. With the advent of mobilization there is a possibility of trailer

NEW OFFICERS OF Midwest Electrical Council, Inc., Minneapolis, are: (L to R) secretary—Wm. A. Ritt, St. Peter; president—John Engel, Rochester; treasurer—F. M. Tripp, Minneapolis; manager—Gordon Tucker, Minneapolis. Berger Indseth, Huron, South Dakota, is vice-president.

It's a SNAP to convert...

old defense installations with T&B Insuliners to meet 1951 NEC bushing rules*



Add T & B Insuliners to standard bushings already installed—or to standard bushings you have in stock right now, as you install them—and you have bushings insulated to the new 1951 National Electrical Code Rules.

INSTALLATION IS EASY!
APPROVAL SURE!

Just slip the split Insuliner over the conductors. Squeeze it together—no tools needed. Then snap it into position—outward pressure on the deep Insuliner groove will keep it *permanently in place.* T & B Insuliners, like *all* T & B fittings, carry full aproval. Use them on all defense reconversion jobs—and you'll wind up with a job that costs less to install . . . and gets quick approval from your local inspector.

ENGINEERED RIGHT . . . SOLD RIGHT!

Insuliners are typical of the many T & B quality fittings recently re-designed to give you lowest installed costs. Like all T & B fittings they're sold 100% through T & B wholesalers . . . the only economically sound way for you to buy electrical fittings . . . the only way, under the T & B Plan, that we sell them. Cut your installed costs by *using* T & B fittings—and by *buying* them through your T & B wholesaler.

THERE'S A T&B ENGINEERED PRODUCT for every defense wiring job in the complete T & B line of fittings for all conductors and raceways.

**The new 1951 NEC bushing rules Paragraphs 2339, 3009, 3736b require you to insulate just about every bushing. Write us for copy of complete code rules.*

THE THOMAS & BETTS CO.

INCORPORATED
34 Butler Street,
Elizabeth 1, New Jersey

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

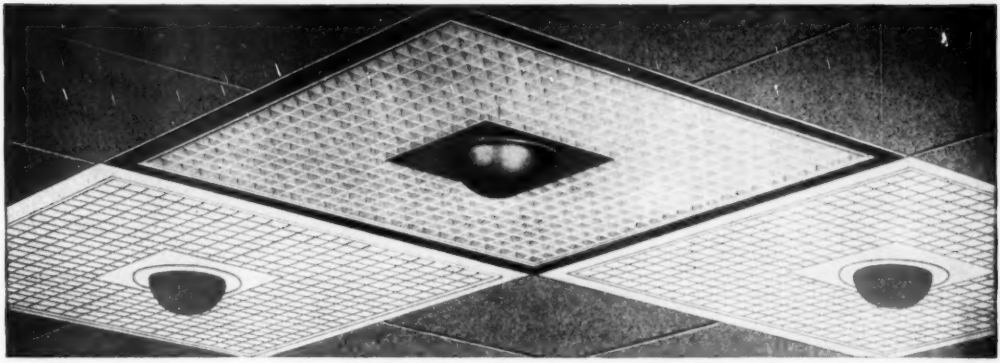
LOCAL LIGHTING for a lathe from an adjustable fluorescent bracket is demonstrated to electrical contractor A. B. Rewald (right) of the Rewald Electric Co., Burlington, Wisc., during one of the individual conferences held recently at a three-day lighting "school" at General Electric Lighting Institute, Nela Park, Cleveland. Forty-nine electrical contractors attended the sessions April 2, 3, and 4. Walter W. Becky (left) of Nela Park, chairman of one of the sessions, points out the need for local lighting in industry to Rewald, who is installing lighting in a defense plant in his area.

camps springing up around industrial plant areas and safety becomes a paramount issue. Inspectors and contractors urged development of specifications for wiring trailers and trailer camp sites. R. A. Peterson, IAEI, told the group that both the National Fire Protection Association and the Trailer Coach Manufacturers Association are working independently on the development of such a standard. This round table session again pointed up the need for more uniform interpretations of Code regulations among inspectors, contractors and all concerned with the manufacture and installation of electrical equipment and systems.

At the business session, the newly organized Suburban Division, Illinois Chapter, IAEI received its charter. Fred P. Oliver, chairman, IAEI membership committee, made the presentation.

Norman H. Davis, Jr., assistant secretary, Underwriters' Laboratories, Inc., Chicago, was elected chairman of the Illinois Chapter for the current year. Carl E. Evans, field engineer, Grain Dealers National Mutual Fire Insurance Co., Danville, Ill., was chosen as first vice-chairman. C. A. Wingfield, supervisor, wiring inspection, Commonwealth Edison Co., Chicago is the second vice-chairman. J. Gordon Maltby, chief electrical inspector, Evanston, Ill., is the new third vice-chairman.

SO EASY to install...to clean...to relamp



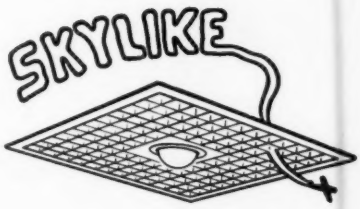
—and these are only a few of its advantages!

The contractor who *puts in* Skylike® lighting likes its light weight and ease of handling—and the freedom from service call-backs (Skylike is simple in construction, simple in wiring—there are no ballasts, starters, accessories, or transformers to need attention).

The man who *maintains* Skylike likes it because he can relamp it from the floor; and because its enamelled ceiling is readily accessible and cleans easily with a damp cloth.

The man who *chooses* Skylike lighting likes it because he gets the modern appearance of fluorescent-type troffers **PLUS** the many advantages of this new application of the silvered-bowl incandescent lamp:

1. **High initial and maintained light output.**
2. **Softly diffused shadows.**
3. **Low brightness and 90° shielding.**
4. **No flickering, blinking, or hum.**
5. **Warm color—most desired by merchandising experts.**
6. **Instant starting.**
7. **Variable lamp size—150- to 500-watt.**
8. **No light loss from darkened walls or ceilings.**
9. **Floor-service relamping—no ladders or scaffolds.**
10. **Hermetically sealed silver reflecting surface.**



Even with all these advantages, Skylike costs only ½ to ⅓ as much as equipment delivering comparable results! It is versatile in application, too. Units fit 24" x 24" ceiling tiles, fully or partially recessed, or may be surface-mounted—in rows or patterns. With a simple accessory, Skylike converts for directional or accent lighting.

RELAMP FROM THE FLOOR! One of the many economies of **SKYLIKE** is its ease of maintenance. No stepladder is needed for relamping—a lamp changer can be used, as shown.

EASY TO CLEAN—The 87% reflection factor of **SKYLIKE**'s enamelled ceiling is easily maintained by occasional cleaning with a damp cloth.

Send coupon for Skylike booklet

Graybar Electric Co., Inc.
Graybar Building,
420 Lexington Ave.
New York 17, New York

Please send me a copy of "Silvray Louvered Incandescent Lighting Systems".

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S12-45

CHICAGO E.M.E. OFFICERS include (L to R) secretary— C. G. Franks; program committee chairman—W. A. Perry, ass't general supt., Inland Steel Co.; vice-president—E. J. Fitzgerald, ass't works manager, E. I. DuPont deNemours & Co., East Chicago, Indiana; executive committee member—A. B. Erickson, electrical foreman, Youngstown Sheet & Tube Co., Indiana Harbor, Ind.; president—Thomas C. Hayes, electrical engineer, Wilson & Company, Chicago.

George Stepanek, electrical inspector, Cicero, Ill., was elected chairman of the Executive Committee. Representing the various industry groups on the committee are: Emil DeHaan (contractors); J. J. Smith (manufacturers); A. J. McGivern (wholesalers)—all of Chicago.

Officers Chosen By Northwest NECA

Elected to lead NECA's Oregon-Columbia Chapter for 1951 are W. R. Grasle, W. R. Grasle Co., president; George Sutherland, Sutherland Electric, v.p.; R. H. Taylor, Ace Electric, treasurer and—to the Board of Directors—S. I. Jagger, Jagger-Sroufe Co.; S. S. Adams, Electrical Construction Co.; A. R. Johnson, A. R. Johnson Co.; J. L. Krauser, J. L. Krauser Co.; Harold Ploense, Harold Electric, and George Schetky, Western Electrical Construction Co. S. I. Jagger, retiring president, was elected to the NECA Board of Governors.

Laurence C. Rodgers, District Secretary-Manager, also reports that the Northwest Line Constructors Chapter will be headed during the same period by George B. Schetky, president; R. C. Hughes, R. C. Hughes Co., v.p.; and W. R. Grassle, sec.-treas.

Five Electric Manufacturers Receive Safety Awards

Electric ignition as applied to the gas range, thus eliminating the continuous-burning gas pilot light, won top honors in the Sixth National Home Safety competition sponsored by Lewis & Conger. Nine other products intended to make the home safer were honored at the Annual Home Safety Awards dinner at the Waldorf-Astoria, New York on April 17.

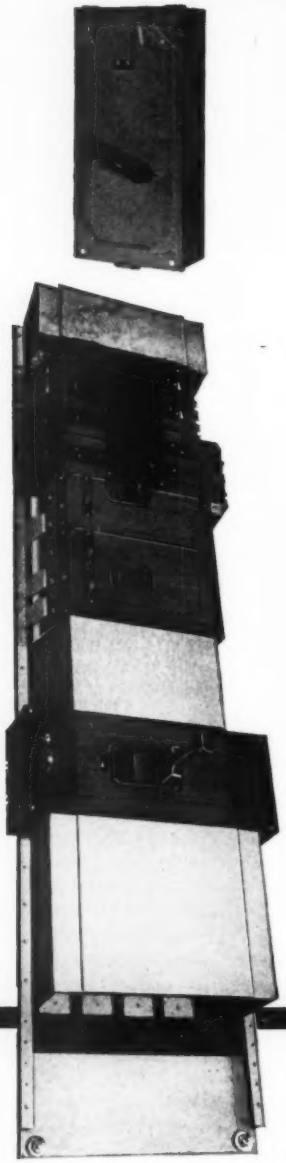
For introducing the new pilot-less stove, the Grand Award went to the Norge Division of the Borg-Warner Corporation, Chicago.

Among the other manufacturers in the electrical field, who received Safety Awards for their contributions to home safety in the past year were: Murray Manufacturing Corporation, Brooklyn, for the Murray Circuit-Breaker, which gives protection in case of overloading or short circuits; Slater Appliances, Inc., Woodside, N. Y. for the Kloz-A-Lite, an automatic light for closets; National Electric Products Corp., Pittsburgh, Pa., for the Plug-In—Strip, providing adequate outlets and proper grounding for electrical appliances; and Miller-Harris Instrument Co., Milwaukee, Wis. for the Robot Sun Lamp, which automatically shuts itself off at the right time.

DOING BUSINESS together for 27 years are (L to R) Frank A. Rossel, now with P. C. Corcoran Co., electrical wholesaler at Mankato, Minn.; and Henry C. Moltzen, electrical contractor at Fairmont, Minnesota.

To meet any Circuit Protection needs

CHOOSE FROM THE COMPLETE LINE OF



I-T-E breakers provide consistent, dependable overcurrent protection in

PANELBOARDS • SWITCHBOARDS
LOAD CENTERS • INDIVIDUAL ENCLOSURES

The full line of I-T-E molded case circuit breakers meets any need. The I-T-E line provides safe, dependable, overcurrent protection for all lighting, power and distribution circuits.

When you choose a circuit breaker made by I-T-E you get:

LONG LIFE—Rugged, dependable I-T-E construction assures maximum service.

EXTRA SAFETY—Completely enclosed terminals mean added protection. Greater pole center spacings afford extra electrical clearance.

EASE OF APPLICATION—Uniform design on multiple pole center dimensions provides ease in mounting and construction. Special devices are available compactly mounted within the breaker case.

I-T-E circuit breakers cover a full range of ratings:

Voltages 125—600 volts a-c
125—250 volts d-c

Continuous current 10—600 amperes

Interrupting capacity 5000—25,000 amperes

1, 2, or 3 poles

Approved by the Underwriters Laboratories, Inc.

For further information on circuit breakers to meet your needs, write I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pennsylvania.

I-T-E CIRCUIT BREAKER COMPANY

Subsidiaries:

Railway and Industrial Engineering Co., Greensburg, Pa.
Eastern Power Devices, Ltd., Toronto, Canada

I-T-E MOLDED CASE CIRCUIT BREAKERS

SELECT THE RATINGS AND DEVICES TO FIT YOUR APPLICATION

Ratings, Protective and Other Devices, Special Features		HQ 50 Amp Frame 1 and 2 Pole	ET 50 Amp Frame 1, 2 and 3 Pole	ET 100 Amp Frame "P" 2 and 3 Pole	ET 100 Amp Frame "Q" 2 and 3 Pole	ET 225 Amp Frame "R" 2 and 3 Pole	ET 600 Amp Frame "L" 2 and 3 Pole
Ratings	Ampere Ratings	10–50 A	15–50 A	15–100 A	50–100 A	70–225 A	125–600 A
	A-C Voltage Ratings	1 P 120 V 2 P 120/240 V	1 P 125 V 2 and 3 P 250 V	LV 250 V HV 600 V	LV 250 V HV 600 V	LV 250 V HV 600 V	LV 250 V HV 600 V
	D-C Voltage Ratings	—	1 P 125 V 2 and 3 P 125, 250 V	LV 125/250 V HV 250 V	LV 125/250 V HV 250 V	125/250 V and 250 V	125/250 V and 250 V
	Interrupting Ratings a-c	5,000 A	5,000 A	LV 5,000 A HV 10,000 A	—	10,000 A	18,000 A
	Underwriters' Labs. Inc. d-c	—	5,000 A	5,000 A	—	10,000 A	10,000 A
	Interrupting Ratings a-c	5,000 A	5,000 A	LV 5,000 A HV 15,000 A	15,000 A	15,000 A	35,000 A
	NEMA d-c	—	5,000 A	LV 5,000 A HV 10,000 A	5,000 A 10,000 A	10,000 A	30,000 A
	Quick-Make Quick-Break Mechanism	✓	✓	✓	✓	✓	✓
Protective Devices	Thermal Trip N	—	✓	—	—	—	—
	Thermal Trip I	—	—	—	—	—	—
	Thermal Fixed Magnetic Trip N	✓	—	✓	✓	—	—
	Thermal Fixed Magnetic Trip I	—	—	—	—	—	—
	Thermal Adjustable Magnetic Trip N	—	—	—	—	—	—
	Thermal Adjustable Magnetic Trip I	—	—	—	—	✓	✓
	Adjustable Magnetic Trip N	—	—	✓*	—	—	—
	Adjustable Magnetic Trip I	—	—	—	—	✓*	✓*
	Undervoltage Trip	—	—	✓	✓	✓	✓
Other Devices	Shunt Trip	—	—	✓	✓	✓	✓
	Auxiliary Switch	—	—	✓	✓	✓	✓
	Alarm Switch	—	—	✓	✓	✓	✓
	Mechanical Interlock	—	—	✓	✓	✓	✓
	Field Discharge Contact	—	—	✓	—	✓	✓
Other Features	Non-Automatic	—	✓	✓	✓	✓	✓
	Oil Immersed	—	—	✓*	—	✓*	✓*
	Center Studs	—	—	✓	✓	✓	✓
	Drawout Connection	—	—	✓	—	✓	✓

* —Available in 250 V d-c, 600 a-c only.
N—Non-interchangeable overcurrent trip.
I —Interchangeable overcurrent trip.

WANT MORE INFORMATION?

Bulletin 5004-D gives description of the complete I-T-E line.

Catalog Section 5000 contains technical selection and application data, dimensions and prices. It's yours for the asking.

R. W. Staud

Rudolph William Staud died March 28 in Evanston, Ill., after several weeks illness.

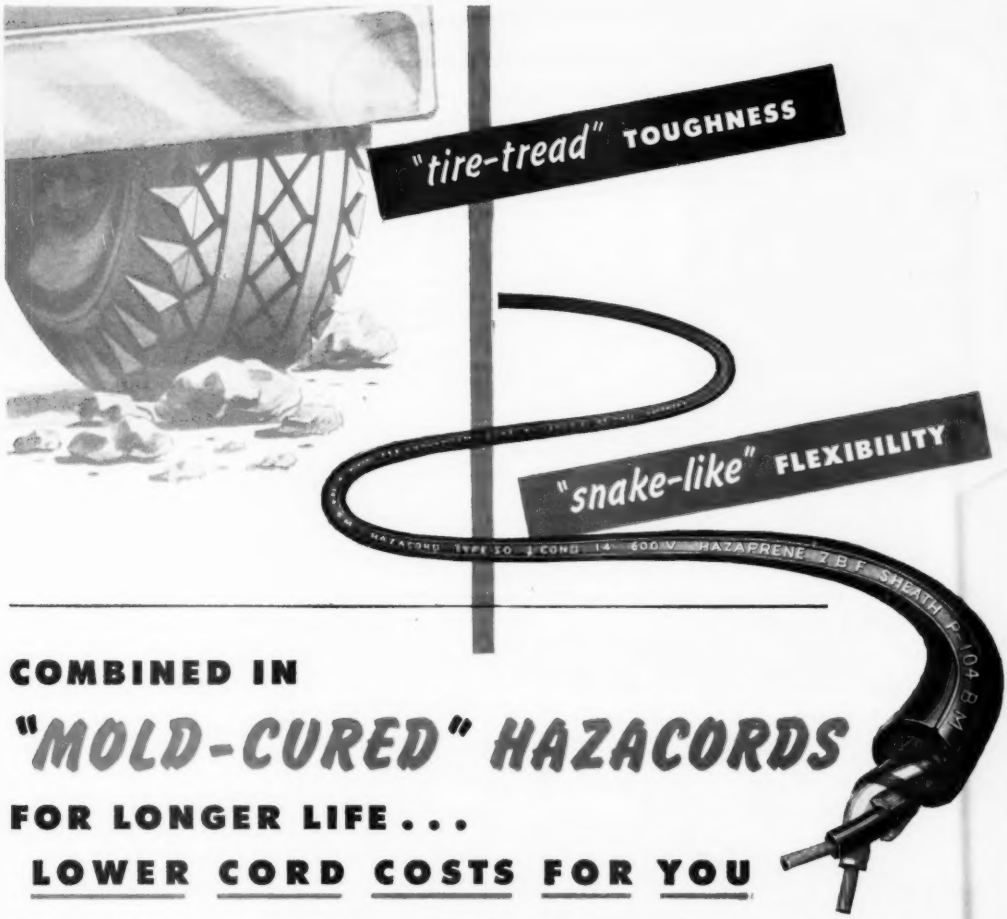
Mr. Staud was an executive of Benjamin Electric Manufacturing Company, Des Plaines, Ill., and one of the best known figures in the lighting industry. He was affiliated with Benjamin Electric as director of public relations and sales promotion since 1927.

For many years Mr. Staud was actively identified in industry wide activities relating to the improvement of lighting practices and the development of high standards of lighting equipment. His activities as a member of many industry and Illuminating Engineering Society committees provided an outstanding record of progress in the lighting industry. He served the RLM Standards Institute as president since 1936. He was past president of the Illuminating Engineering Society, the National Industrial Advertising Association and the Porcelain Enakel Institute. He was a director of the Chicago Lighting Institute and served in an executive capacity for the lighting industry's three International Lighting Expositions.

Methods Forum Promotes Critical Production

"Modern Methods for Critical Production" titled a six-session forum presented before over 1000 hand-picked Jersey industrial plant management and maintenance men during the last three weeks of April. On the premise that *nothing* is of greater importance to our immediate national security than all-out production, the forum included such production-fostering topics

NEW PRESIDENT of the Minnesota Electrical Association (contractors outside Twin-Cities area) L. A. McClure, Luverne (right), receives the Association record book from retiring president C. D. Burton, Brainerd, at recent annual convention in Minneapolis.



COMBINED IN

"MOLD-CURED" HAZACORDS

FOR LONGER LIFE . . .

LOWER CORD COSTS FOR YOU

You've probably found it true, too, that the service life of portable cords and cables — the true measure of cable economy — depends primarily on the toughness, lasting qualities and flexibility of the sheath. Today's Hazacords are the result of many years of Hazard and Okonite experience in developing portable cables and cords for unusually severe service, such as encountered in mining operations.

Every Hazacord is protected with the specially developed Hazaprene ZBF Sheath. *It's cured under pressure in a continuous metal mold* which assures optimum vulcanization, maximum density, lasting toughness, a smooth, wear-resisting surface — and at the same time, ample flexibility is maintained. The Hazaprene ZBF Sheath is a time-proved neoprene compound with maximum resistance to oils, acids, chemicals, moisture and weather. In addition, it is highly flame-resistant — more than meets the flame test requirements of the Federal Bureau of Mines and the Pennsylvania Department of Mines. All Hazacords are insulated with tough, heat-resisting, long-aging rubber compound for full electrical protection.

It will pay you today to get in touch with your Hazard representative for all the facts about Hazacords. He can help you start benefiting from a new high standard of performance with your portable cords and cables. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

9028

TWIN-CITY MANAGERS of electrical contractors are: (L to R) Dan Gephart of the St. Paul Electrical Contractors Association; and Oscar F. Norgren of the Minneapolis group.

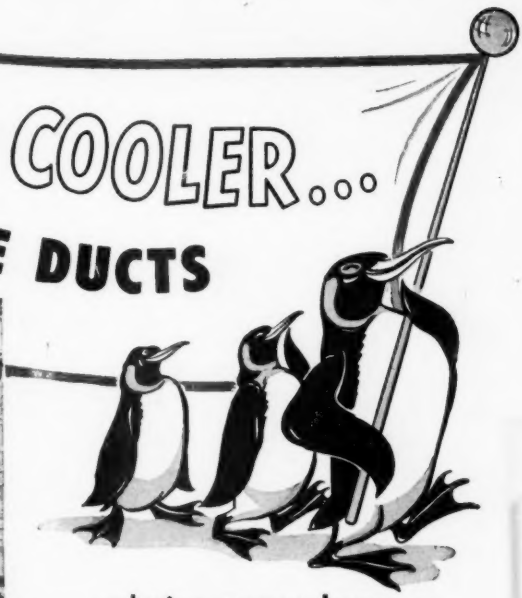
as power distribution, adjustable-speed drives, electric heating sources, materials-handling equipment, planned lighting, electronic controls, scheduled maintenance, research, and power generation. Jointly-sponsored by the General Electric and Public Service Electric & Gas companies, the program was led by 27 men from these two companies; men who, over the 3-week period, traveled to six key Jersey cities to more effectively reach production men in all parts of the State.

Power distribution was characterized as the nerve system of industrial plants, since "the power system is the vital link connecting power sources to production machines to produce manufactured products." Enumerated and discussed were such trends in distribution systems as load center unit substations, plug-in bus duct, higher utilization voltages, new types of short-circuit protection, and grounding methods. Between forum cities, this discussion was led alternately by D. L. Beeman and G. L. Taft.

How the output of many machines has been doubled and even tripled by the application of electric speed control was similarly told by H. M. Kenney and W. D. Lee, who graphically illustrated the basic advantages of adjustable-speed drives. It was stated that, "In the face of today's critical need for increased production, the answers in motor drive applications lie in seven clearly defined areas." These included suiting the machines' speed to required tasks, making machines more versatile, stepping up quality control, reducing waste and spoilage, saving vital floor space, reducing modernization costs and simplifying complex operations.

"Heat Where You Want It", discussed by E. H. Rusch and R. W. Kise, including analysis of batch type

Cables run COOLER...
in TRANSITE DUCTS



... reducing copper losses
... increasing current capacity
... prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV
(6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386	365
Allowable Current—(Relative %)	105.6	1.00

Johns-Manville *Transite Ducts*

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

FATHER AND SON form a duo of presidents. W. S. Collins (left), Collins Electric Co., Minneapolis, is president of the Minneapolis Electrical Contractors Association. W. N. Collins, Collins-Hegberg Electric Co., St. Paul, is president of the St. Paul Electrical Contractors Assn.

and continuous furnaces. Industrial electric heaters were also presented for heating liquids, surfaces, process air, metals and pipelines. This group of units covered screw-in and over-the-side immersion heaters, tubular and strip heaters, cartridges, finned elements and flexible resistance-wire cables.

"The cost of materials handling in a manufacturing plant is seldom less than 20% of the total cost of the manufactured article and, in certain bulk industries, this can rise to 80%. The general average for all industry is from 25 to 30%," stated H. T. Todd and C. B. Elledge. They showed how to replace manpower (today's key to higher production) with horsepower, illustrating their points by reference to latest equipment, methods and techniques in the materials-handling field.

Light—the indispensable member of the production team—was discussed by the Public Service team of Leon T. Johnson and Eugene M. Fahey in a duologue combining slides and exhibits. In their presentation, stressing the importance of the human eye, the visual task and the available light, they mentioned WPB statistics to prove that adequate, well designed lighting reduced the number of rejects, produced better workmanship, helped older workers to continue on the job, resulted in less eyestrain, fewer accidents, better morale and better housekeeping. They also demonstrated that industrial tasks are dependent upon size, illumination, contrast and time. Examples of good and poor lighting were illustrated, and methods for improving existing inadequate lighting installations were cited.

Controls that think and act automatically for increasing production

THE NEW

Polyken®

INDUSTRIAL TAPES

TAILORED TO YOUR JOB

EIGHTEEN TIMES THE FORCE OF GRAVITY is secured with *Polyken* Tape No. 276. Picture taken at the Aerojet Engineering Corp.

We're over Peoria, *weren't* we?

Shades of Kitty Hawk!

When a man can get up in the air and, with jet power, go over 650 m.p.h., it's time we oldsters hit for the tall weeds. That's more than 10 miles a minute—or about the distance Pop covered in an hour when he took the eggs to town.

Another use of jet power is in shortening the take-off distances of propeller-driven planes. When the Aerojet Engineering Corp. introduced JATO (Jet-Assisted Take-off), distances were cut 50%. But possible trouble existed, because when the jet was ignited, the terrific initial thrust tended to rip the charge loose from its shell.

The Polyken Sales Engineer suggested *Polyken* Industrial Tape No. 276 to lick this problem. *Polyken* No. 276, a Fiberglas*-backed pressure-sensitive tape strong enough to resist a pull of 14,500 pound-seconds (or 18 times the force of gravity), is used to bind the plug and cap assembly that secures the charge to the shell. The tape is strong enough to keep the charge from moving when the powerful energy thrust occurs.

We tell you the JATO story as an example of how tape that's "tailored to your job" can do things you never dreamed tape could do. Let us study *your* problem, and we'll come up with a tape that will save you money, time and effort. That's a challenge. Won't you take us up on it?

*Reg. U. S. Pat. Off. by Owens Corning Fiberglas Corp.

FREE SAMPLES. Write today for complete engineering data, plus samples of *Polyken* No. 276. Address *Polyken*, Dept. ECE, 222 West Adams Street, Chicago 6, Illinois.

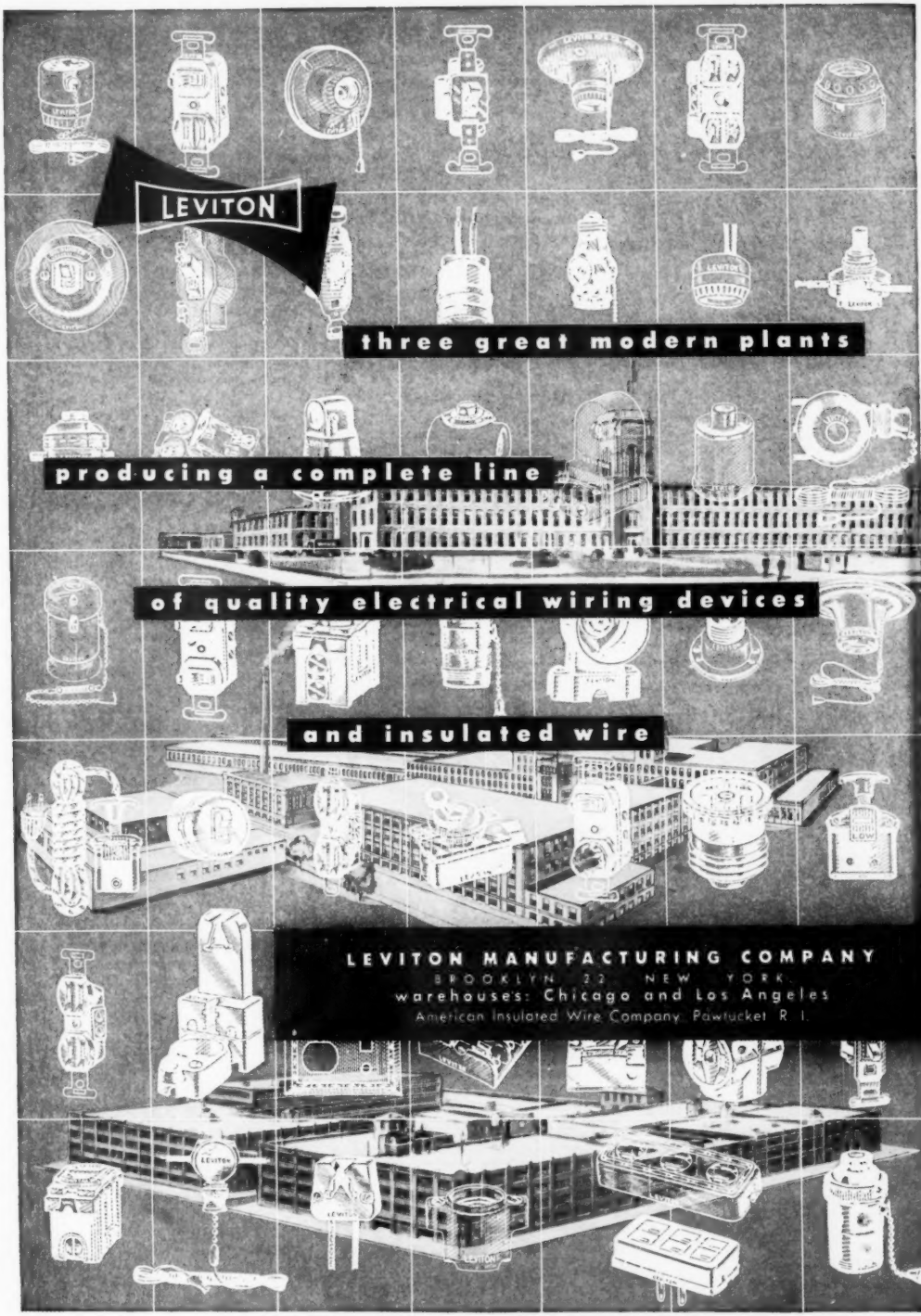
***Polyken* Industrial Tape, Department of Bauer & Black, Division of The Kendall Company**

PRE-SESSION HUDDLE at annual meeting of Minnesota Electrical Association in Minneapolis finds electrical contractors (L to R) Theodore Hojem, Westbrook; A. J. Buschena, Fulda; and Everett Taylor, Wayzata, Minn., discussing conference agenda.

with lower costs and higher quality were analyzed by K. P. Grenfell, A. H. Moore and A. L. R. Maynard. Explaining that all automatic systems involve detection, amplification and control of power, they gave numerous examples where phototubes, electronic relays, adjustable-speed motor controls, tensiometers and thermocouples can be advantageously used in industry for controlling the operation of doors, conveyor belts, oil burners, printing presses and other types of equipment.

Preventive and planned maintenance was outlined by C. G. Frei and P. E. Fisher, who indicated several shortcut maintenance methods, typical distress signals to observe, and procedure outlines. "One of the weaknesses in any of our plants today is the lack of responsibility given the maintenance organization," they said. "Management is accustomed to measure results strictly by unit costs, putting maintenance at a disadvantage. Any maintenance engineer can cut maintenance costs to the bone by letting the plant go to pot, but there is no economy in that. Maintenance *must* be given a position equal to production if the facilities are to be kept running." Analyzing the features of a good maintenance program, they discussed routine inspections, the establishment of a card record system, essential tools, stockrooms and supplies.

Imparting the newest and best ideas in industrial electrification to the hundreds of operators and supervisors who can profitably use them is a big job that can be accomplished through packaged visual programs, individual calls by salesmen representing manufacturers and utility companies, advertising and editorial material in trade magazines, direct mail, handbooks and catalogs, trade shows and industrial



Visit the **LEVITON** Booth No. 87-88 at the Wholesalers' Convention

RURAL WIRING SPECIALISTS Robert Savsten and Earl Odmark (right) of Odmark Electric Co., Cambridge, Minn., find that farmers are demanding the neoprene sheathed barn cables when wiring or rewiring their farms.

film libraries. This story, with graphic illustrations of each type of communications, was presented by C. A. Graham, R. H. Rensch, C. D. Pease.

"What's Ahead in Research and Development?" was the question asked and answered by Warren C. Hutchins and William E. Herrmann who discussed not-yet-commercially-available equipment and materials.

Public Service system engineer C. S. MacNabb concluded the forum by briefly recounting the history and development of Jersey's electrical growth and his company's part in keeping ahead of the State's power requirements. "The task assigned to each of us is clear," he stated. "It is for us, the electric utility, to supply the power. It is for you, the industrial plant, to manufacture the material."

The forum, em-ceed by Frank C. Pesveye of P. S. and F. W. McChesney of G. E., was planned to include subjects of greatest interest and helpfulness to New Jersey industrial men. Topics were selected after analyzing hundreds of replies to an organizational pre-conference letter. Material for presentations was wholly non-commercial and non-promotional in nature, fulfilling the forum's objective of bringing valuable, modern and timely help on current production problems.

Patterson Forecasts Skill Shortage

W. F. Patterson, Director of the U. S. Bureau of Apprenticeship, praised the support the National Apprenticeship program is getting from the National Electrical Contractors Association and the IBEW, but warned that, since Korea, more apprentices are dropping out than are coming into the program. He spoke

INSURANCE PROTECTION for electrical contractor employees is the subject of this huddle between: (L to R) R. J. McMorrow, sales manager, Hardware Mutual Insurance Co. of Minnesota; E. H. Fillbrandt, contractor of Winthrop, Minn.; and A. S. Lund, Glenwood Electric Service, Glenwood, Minnesota. Group met at Electrical Industry Convention in Minneapolis.

at the 10th annual meeting of District 5, NECA, at Pheonix, Ariz., April 23.

Apprentices are entering the armed forces at a rate of 1,000 a month, and this might go up to as high as 2,000 a month, Patterson said, forecasting a serious skilled worker shortage in three or four years.

Yet, Patterson pointed out, in the two years preceding Korea, 18,000 apprentices were trained in the construction industry while only 12,000 journeymen were lost through death, retirement or permanent disability. This was the first time, he said, that the number of new journeymen entering the trades exceeded the loss of journeymen in a major industry.

Wiring Devices IAC Meets

The Electrical Wiring Devices Industry Advisory Committee, recently established by the Industry Advisory Committee Bureau of the National Production Authority, U. S. Dept. of Commerce, held its first meeting in Washington, D. C., on April 23, 1951. L. D. Shank, Chief of the Electrical Products Branch of the NPA Building Materials Division, presided at this meeting. The Committee recommended to NPA the formation of two task committees from its industry, the first to make a study of the industry's problems on material requirements and the essentiality of the industry's products, the second to investigate possibilities of conserving materials by standardization and simplification of electrical wiring devices.

NPA told the Committee that, because of defense demands, steel, copper, aluminum and phenolic resin molding powders for plastic coverings will continue in short supply. As a result, the industry was asked to devise any means possible to conserve the use of brass and copper.

Zinc, tin, lead and nickel are also in short supply, NPA told the Committee. Also, most mills are feeling the pressure of defense rated (DO) orders. But the Controlled Materials Plan, scheduled to go into effect at the beginning of the third quarter of the year, should help alleviate these shortages as well as those in steel, copper and aluminum, NPA said.

While residential building in March was 10% above that of the same month last year, NPA told the Committee the peak will shortly be reached and that type of construction can be expected to decrease.

Commercial building is expected to remain about the same, NPA said, but industrial construction may increase so that the overall requirements for wiring devices in construction should remain about the same as at present.

Shortages now developing in phenolic resin powders, benzol supplies and urea and formaldehyde components of plastics used in the industry may become more acute in the immediate future, NPA officials reported.

Members of the Electrical Wiring Devices IAC who were present at the April meeting were as follows: Robert E. Carroll, Arrow-Hart and Hegeman Co., Hartford, Conn.; H. E. Serin, Bryant Elec. Co., Bridgeport, Conn.; J. J. Grossman, Cable Electric Products, Inc., Providence, R. I.,

FALLACY OF TRYING to estimate and bid on a set of poorly engineered plans and specifications is pointed out to Minnesota electrical contractors at recent Minneapolis meeting by consulting engineers Borge Neilsen (left) and T. E. Roche representing the Minnesota Association of Consulting Engineers.

HEADING OFFICIAL family of the North Dakota Electrical Contractors Association are: vice-president—A. O. Holmes (left), Holmes Electric Co., Minot; and president—Wes Severson, Prairie Electric Co., Valley City.

Herman B. Ring, Circle F Mfg. Co., Trenton, N. J.; J. H. Tuttle, Deal Electric Co., Inc., Brooklyn, N. Y.; T. D. Foster, G. E. Co., Bridgeport, Conn.; Harvey Hubbell, Harvey Hubbell, Inc., Bridgeport, Conn.; O. A. Dorsett, Knox Porcelain Co., Knoxville, Tenn.; B. I. Leviton, Leviton Mfg. Co., Brooklyn, N. Y.; A. F. Warren, Monowatt, Inc., Providence, R. I.; C. L. Nicholson, II, Pass & Seymour, Inc., Syracuse, N. Y.; A. R. Johnson, John I. Paulding, Inc., New Bedford, Mass.; and Saul I. Slater, Slater Elec. Mfg. Co., Woodside, N. Y.

Grey Heads NISA Southeastern Chapter

H. Hall Grey, Southern Electric Service Co., Greenville, S. C., was elected president of the Southeastern Chapter, National Industrial Service Association at the recent annual meeting of that group in Greenville, South Carolina.

Also elected to the official family at that time were: vice-president—O. A. Clot, Peninsular Armature Works, Miami, Fla.; and secretary-treasurer—W. S. Ward, Electric Motor & Repair Co., Raleigh, North Carolina.

C-C Lighting Forum

The Fluorescent Lighting Association sponsored a cold cathode lighting forum early this spring, which was held in the Hotel New Yorker, New York City, concurrently with the annual winter meeting of the National

MOTOR SHOP owner F. H. Westphal (left), Westphal Electric Co., Janesville, Wis., discusses business prospects with his sales manager George Thompson at Central District Chapter, NISA meeting in Chicago.

Electric Sign Association. The forum was devoted to such topics as cold cathode application, world acceptance, versatility, and potential contribution to the present national emergency. Five speakers gave short talks, which were followed by a lively question and answer period.

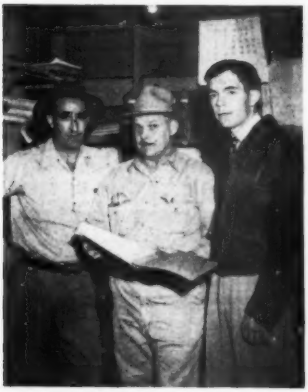
Chairman of the session was Charles Sabatini, president of the Fluorescent Lighting Association and president of Colonial Electric Products, Inc., East Paterson, N. J. He was also first speaker, and discussed the "Past, Present and Future of Cold Cathode Lighting".

"Cold cathode lighting started about 15 years ago", Mr. Sabatini said. "The pioneers in cold cathode lighting were not the 'giants' of industry", he related, and concluded, "Had the advantages of cold cathode lighting been

STUDYING ELECTRICAL MODERNIZATION plans of Bullock's downtown Los Angeles store are Howard Stockton, field superintendent for R. R. Jones Electric Co., contractors on the project; and Harold W. Snyder, electrical supervisor for Bullock's, Incorporated.

supported by 'the giants', it would have been world shaking". Lack of information, and the tendency of people to resist change, contributed to holding back a greater acceptance of c-c lighting, according to Mr. Sabatini. Cold cathode's strong entering wedge (into the lighting industry) was World War II, when its producers were awake to the problem of better lighting for industry, he indicated.

He then discussed c-c lamp life, and efficiency, and named eight features of c-c lamps. Efficiency is 72% average at the end of 8000 hours of burning, he stated, and many lamps have been in use more than 30 thousand hours (burning time). The names of many large users were given, including one that installed 15 thousand lamps in



SUPERVISING TRIO for the H. P. Foley Company on the Kennecott Copper Corp. refinery near Salt Lake City, Utah, were: (L. to R) A. O. Staker, general superintendent; Walter Ross, project superintendent; and G. A. Ruede, electrical engineer.

1936 and today has over 150 thousand c-c lamps in use. The standard and special applications of c-c lamps were also discussed.

Cold cathode lighting has wide acceptance in many foreign countries, Mr. Sabatini pointed out, naming Italy, Mexico, Cuba, and most South American countries, among others.

Second speaker was G. W. Miller, vice president of Q-R-S Fluorescent Lighting Co., Toronto, Canada, who discussed "Cold Cathode in Canada". He outlined merchandising techniques used by his company to sell c-c lighting, which business they began in 1942 as an adjunct to their sign business, operated under the firm name of "Outdoor Neon Displays, Ltd.". Mr. Miller reviewed several jobs, how the jobs were sold, and stressed the importance of separate salesmen and layout men for selling c-c lighting as contrasted to

PRODUCTION MANAGER Emil O. Harry keeps repaired motors rolling out of Holt Electric Motor Company shop in Milwaukee; has 30 men on his motor repair staff.

neon sign salesmen and designers. He said they found it necessary to change their name to "Q-R-S Fluorescent Lighting Co." in order to get into war plants in War II, and then stressed the importance of name identification of product.

"Cold Cathode Lighting and the War Economy" was the topic for Vic Todd, president, Swedish Iron & Steel Corp., Westfield, N. J., the third speaker. Because of the long life of c-c lamps, Mr. Todd pointed out that c-c lighting conserves one of the nation's most critical shortages—manpower (on the premise that maintenance and lamp replacement is not required for c-c lighting). He then

PROMINENT IN CHICAGO electrical contractor association activities are: (L to R) C. P. Walters, Fries-Walters Co.; Oliver F. Burnett, Jr., Kelso-Burnett Electric Co., and newly elected NECA vice-president for District 4; and W. J. Howe, J. Livingston & Company.

LINE CONTRACTORS in a huddle at recent Power and Communication Contractors Association convention in Chicago are: (L to R) Patrick L. Size, Miller Construction Co., Vincennes, Ind.; and T. L. Trawick, Victory Electric Co., Mobile, Alabama.

recounted the experiences of the c-c industry in trying to convert from the production of c-c lamps for industrial and commercial lighting, during War II, including the difficulties of obtaining the acceptance of c-c lighting by industry and various government agencies, including the War Production Board. Cold cathode lighting systems did not require the use of any critical materials, he said, and explained that the c-c industry was finally able to obtain allocation of enough copper (then highly critical) to make a token quantity of high voltage transformers required to operate the c-c lamps, which aided the industry in

SALES PROMOTION minded Karl Krummel, partner and general manager of Collier Electric Company, Denver electrical contracting firm, has been active in promotion and design of floodlighting systems for public recreation areas and school athletic fields.

B. A. HANNEWALD, vice-president and general manager of Scherer Electric Co., Indianapolis motor service organization, is a keen student of operating efficiency and maintains one of the best equipped shops in the state.

getting a start. He blamed normal competition of the already established lighting industry, which he termed "the industry giants", for most of their troubles, and inferred a lack of cooperation for the c-c industry by various federal agencies.

At the conclusion of Mr. Todd's talk, Forum Chairman Sabatini commented that the FLA members on the panel had reviewed Mr. Todd's address before coming to the meeting, and had approved it as given.

Mr. Sabatini next introduced Mr. Hamell, an attorney of the Department of Justice, Washington, D. C., as a friend of the c-c industry and FLA, and a guest at the meeting.

Miles Pennybacker, president of

FLEXIBLE SUPPORTS for cables and conduits get thorough inspection at Milwaukee EME show by: (L to R) H. Rodewald, electrician, Briggs & Stratton Corp.; Arthur Thom, Boggis-Johnson Co.; A. W. Schwind, Unistrut Products Co.; and Elmer Griggs, electrician, Briggs & Stratton Corp.—all of Milwaukee.

JAMES S. KUSTER, co-partner of Kuster-Wetzel Electric Co., Long Beach, California, enjoys a challenging problem. His most recent project is just that. His firm is wiring 17,000 houses and installing some 5,000 street light standards in the tremendous Lakewood Park housing development just outside of Long Beach.

Voltair Tubes, Inc., Norwalk, Conn., was next introduced, who talked on "The Cold Cathode Fluorescent Lamp". He described the technical aspects of c-c lamps, and explained how and why they differ from "hot cathode" fluorescent lamps.

Bernard F. Greene, consulting engineer of New York City and Technical Director of the Fluorescent Lighting Association, gave the final talk on "Cold Cathode Engineering". His comments related to both engineering and application details, which were supplemented by a number of lantern slides showing some outstanding c-c lighting installations across the country and in Canada.

The meeting concluded with a question and answer period, in which members and guests took a lively and active part.

CCECA Re-elects Officer Slate

Leo W. Witz, Continental Electric Construction Compay, Chicago, was elected for another term as president of the Cook County Electrical Contractors Association in Chicago. Other incumbent officers re-elected were: vice-president—Frank M. Block, Block Electric Company; secretary—Abe Sluis, Sluis Electric; treasurer—Erwin Kaufmann, Kaufmann Electric Company. All are in Chicago.

New members of the Board of Directors are Leonard Horwitz, Leonard Electric Construction Co.; and E. H. Wigdahl, Wigdahl Electric Company

IN NEW QUARTERS but still considering expansion is Hugh W. Myers, owner of Myers Electric Company, Salt Lake City motor repair shop. With industrial work his largest volume, he is continually increasing his shop efficiency.

in Chicago. Incumbent members serving another term on the Board include: Anton J. Mayer, Buck Electrical Contractors, Inc., Fred A. Spandau, Spandau Electric Co.; Joseph C. Spinar, Cable Electric Co.; W. J. Templeman, Premier Electrical Construction Co.; and A. A. Wohlgezon, Builders Lighting Fixture Company—all of Chicago.

BOOK REVIEW

Electrical Appliance Servicing

With the number of home appliances constantly growing, the maintenance and repair of these electrical devices is creating opportunities for many shops devoted exclusively to this field of endeavor. The required capital investment is small for, aside from the necessary tools and testing equipment, replacement parts constitute the main items of expense. Successful maintenance, therefore, depends not so much on capital as it does on know-how, and William H. Crouse's book on "Electrical Appliance Servicing" provides much of this understanding.

Numerous drawings and photographs (sectional, exploded, operational and step-by-step servicing hints) clearly explain the construction of equipment, their proper assembly, the possible causes of failure and methods for repairing the devices. The book separates appliances into three categories: resistance-heating units (such as irons, toasters, water heaters, ranges, broilers and waffle bakers), motor-driven units (fans, blowers,

UTAH CONTRACTORS exploring the impact of present mobilization plans on their business are: (L to R) J. E. and N. W. Forsberg, Wasatch Electric Co., Salt Lake City; R. B. Swaner, Robert B. Swaner Electric, Salt Lake City; and L. A. "Pete" Herdti, Odgen Electric Co., Odgen.

water pumps, clocks, vacuum cleaners, dishwashers and garbage disposal units) and refrigeration and air conditioning.

While it would be possible for an electrician to efficiently repair home appliances, following the recommendations contained in only these three sections of the book, an introductory section on electric fundamentals serves as a review for the experienced man and a study course for the student or average home owner. Principles of electricity, basic home wiring, recommended shop and safety practices, the theory of motors, generators, transformers and batteries, efficient small shop layouts, a list of required tools, simple service-record cards, invoices and work-order books are discussed in detail. As a check on the reader, a list of questions is contained at the

ELECTRIC CLUB of Dayton, Ohio, has its officers: (L. to R) president—Herbert Snead, executive secretary, Dayton Adequate Wiring Bureau; secretary-treasurer —T. E. Bennett, power engineer, Dayton Power & Light Co.; vice-president—R. G. Taylor, representative, Bussmann Manufacturing Company.

DIRECTORS OF the Milwaukee Electrical Maintenance Engineers association include the following industrial plant members: (L to R) E. C. Siller, chief electrician, Phoenix Hosiery Co.; H. K. Drews, chief electrician, Chain Belt Co.; W. Hammargren, ass't. plant manager, Lindemann-Hoverson Co.; and W. Lampiris, chief engineer, Geuder, Paeschke & Frey—all of Milwaukee.

termination of each chapter pertaining to the information in the particular section being studied and, for the student or serious reader, auxiliary study assignments are recommended.

The appendix contains first aid hints, characteristics of fractional-horsepower motors and recommended servicing equipment. An alphabetical index facilitates rapid reference. Published by the McGraw-Hill Book Company, Inc., New York City, the book contains 854 9-by-6-inch pages and is priced at $7.50.

P. H. DONOHOE is general manager of Glow Electric Company, large rebuilt and surplus machinery firm in Cincinnati, Ohio. A shop crew of about 30 men are kept busy repairing and rebuilding everything from electric motors and transformers to diesel units.

Among the Manufacturers

Headquarters Announcements

Westinghouse Electric Corp., Pittsburgh, Pa.—Mark W. Cresap, Jr., vice-president and assistant to President Gwilym A. Price.

Emerson Electric Mfg. Co., St. Louis, Mo.—Raymond E. Otto, vice-president and general sales manager.

Westinghouse Electric Corp., Bloomfield, N. J.—Herbert E. Plishker, sales manager of the Lamp Division; Harold G. Cheney, headquarters administrator for lamp sales; Dr. Roland M. Zabel, manager of Lamp Division engineering.

General Electric Company, Schenectady, N. Y.—E. W. Cunningham, acting manager of Industrial Heating Divisions.

General Electric Company, Bloomfield, N. J.—F. J. Van Poppelen, general manager of the Air Conditioning Department.

General Electric Company, Fort Wayne, Ind.—Elmer F. Paul, manager of manufacturing, Specialty Transformer and Ballast Divisions.

Jefferson Electric Company, Bellwood, Ill.—J. D. O'Brien, sales manager.

Johns-Manville, New York, N. Y.—William R. Wilkinson, vice-president for sales; Kenneth W. Huffine, vice-president for production.

Automatic Transportation Co., Chicago, Ill.—Theodore F. Smith, assistant general manager.

The Formica Company, Cincinnati, Ohio.—Louis J. Francisco, vice-president in charge of sales and advertising.

York Corp., York, Pa.—Rodney F. Lauer, vice-president in charge of engineering and research.

Electronic Tube Corp., Philadelphia, Pa.—Henry S. Bamford, president.

ILG Electric Ventilating Co., Chicago, Ill.—Richard I. Hanford, head of the engineering department.

Square D Company, Detroit, Mich.—L. W. Mercer, executive vice-president F. H. Roby, vice-president in charge of sales and director; L. G. Maechtlen, vice-president and director.

General Electric Company, Bridgeport, Conn.—Clarence H. Linder, general

manager of the Major Appliance Department.

Janette Mfg. Company, Chicago, Ill. —announces the purchase of the subfractional Gear-Motor business of Robbins & Myers, Inc. of Springfield, Ohio.

Regional Appointments

MIDDLE ATLANTIC

General Controls Company: Fred H. Angier, district manager for Philadelphia and Baltimore.

The Pyle-National Company: Walter E. Daw, representative in Syracuse, N. Y.; L. J. Daniels, representative in Baltimore, Md.

Hope Electrical Products Co.: Norman Brager, New Jersey representative.

EAST CENTRAL

Sylvania Electric Products Inc.: W. J. Rashleigh, lighting sales manager for the Chicago division; Paul T. Owens, lighting sales manager for the Milwaukee division.

Allis-Chalmers Company: Stanley E. Bovim, manager of new Peoria, Ill., branch office.

Cutler-Hammer Inc.: O. P. Proudfoot, district manager of the Cleveland sales office.

Graybar Electric Company: W. E. Guy, assistant manager of the Chicago district; L. C. Esthus, sales manager of the Chicago district.

WEST CENTRAL

Sylvania Electric Products Inc.: Myles Gaythwaite, lighting sales manager for the St. Louis division.

Graybar Electric Company: D. M. Hitchcock, branch manager for Des Moines.

SOUTH ATLANTIC

Cutler-Hammer Inc.: Frank A. Miller, Jr., and C. Lee Shaw, staff of new Charlotte, N. C., branch office.

The Pyle-National Company: W. H. Lassiter, Jr., representative in Richmond, Va.; Lynn H. Morris, representative in Roanoke, Va.

SOUTH CENTRAL

Sylvania Electric Products Inc.: T. J. Ewbank, sales manager of the new Dallas, Texas, division of the Lighting Sales Department.

WEST

Edwards Company, Inc.: Robert L. Kempton, district manager of the San Francisco office.

NISA MEETS IN TEXAS

[FROM PAGE 69]

lems was the rule at these sessions. Tools, materials, techniques and results were the subjects most generally explored.

Such top management topics as material procurement, manpower, advertising, sales expense, overhead, financing and the competitive effect of repair shops operated by equipment manufacturers received searching analyses in the management forum.

At the annual business session, the membership report revealed that NISA now has a roster of 1,221 members. Of this total 809 are active members associated with chapters; 361 are active non-chapter members; the rest associate members of the group.

Approved at this session were two important resolutions bearing on the present economic situation. The first was a resolution recommending that NISA urge Congress to act to eliminate the present two-cent per pound import duty on foreign copper as one means to alleviate the shortage of raw copper. The second, called for NISA

Ted Radig, Ted Radig Electric Co., Emporia, Kansas; **A. O. Kleen,** The Electrical Service Co., Inc., Austin, Texas.

Charles H. Stark, Stark Electric Co.; **J. Roland Stolzenbach,** The Roland Electrical Co., both of Baltimore, Maryland.

SEARCHLIGHT SECTION

Al H. Barrere, J & J Armature Works of La., Inc., Lake Charles, La.; **Robert B. Turner,** Johnson-Turner Electric Repair & Engineering Co., Ltd., Windsor, Ontario, Canada.

to urge Congress to repeal the Walsh-Healy Act which Board members feel is disruptive to small business operation and inflationary in nature.

New officers elected to the 1951-52 term include the following: President —M. F. Zack, Zack Brothers Electric Co., Mason City, Iowa; vice president —R. A. Scherer, Scherer Electric Co., Indianapolis, Ind.; secretary—H. A. Lilly, Tampa Armature Works, Inc., Tampa, Fla.; treasurer—C. R. Durand, H. N. Crowder, Jr., Co., Allentown, Pa. Fred B. Wipperman is executive-secretary of the group.

Alfred Elson, Jr., New England Machine & Electric Co., Pawtucket, R. I., was elected as Director from Region 1 to fill the unexpired term of Fred H. Ferris of Boston who recently resigned. Three Directors-At-Large were elected by the Board: Charles J. Covington, Dowzer Electric Machinery Works, Inc., Mt. Vernon, Ill.; Joseph H. Previty, Penn Electric Motor Co., Philadelphia; and H. Ed

M. J. McCarthy, Anaconda Wire & Cable Co., Muskegon, Mich.; **C. F. Bowers,** Tri-State Supply Corp., Los Angeles, Calif., **E. Fred Luna,** Anaconda Wire & Cable Co., New York City.

Grant, Tennessee Electric Motor Service, Nashville.

Top cash award of $100 in the NISA Award Contest went to Roscoe Ruppe of the Southwest Electric Co., Oklahoma City. Second prize of $75 went to Walter Bailey, Central Armature Works, Inc., Washington, D. C. Stanley Polasik, Arthur Wagner Co., Chicago received the third place award of $50. Fourth prize of $25 was received by C. A. Bonham, Phoenix Electric Co., Mansfield, Ohio. Ten other honorable mention awards of $10 each rounded out the contest prizes.

For the first time in the history of NISA, award citations were presented to members who have been active in the electrical field for the past 50 years or more. Eight "old-timers" received citations at the annual banquet. They were: F. L. O'Brien, The O'Brien Machinery Co., Philadelphia, Pa.; E. C. Masters, Masters Electric Service, Albany, Texas; Bernard Shell, Guyan Machinery Co., Logan, W. Va.; James G. Spaulding, Sr., Spaulding Electric Co., Inc., Detroit, Mich.; C. J. Briner and F. E. Briner, Briner Electric Co., St. Louis, Mo.; Paul G. Winter, American Electric Co., Indianapolis,; and S. J. Stewart, S. J. Stewart Elect., New Orleans.

John R. Lange, Jr., Lange Electric Co., Baltimore, Md.; **Walter Bailey,** Central Armature Works, Inc., Washington, D. C.

J. E. Bergland, Alexandria Armature Works, Alexandria, La.; **Carl Pons,** Carl Pons Elect. Co., Shreveport, Louisiana.

Advertising In This Issue

SEARCHLIGHT SECTION

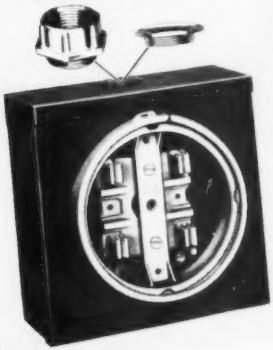
(Classified Advertising)

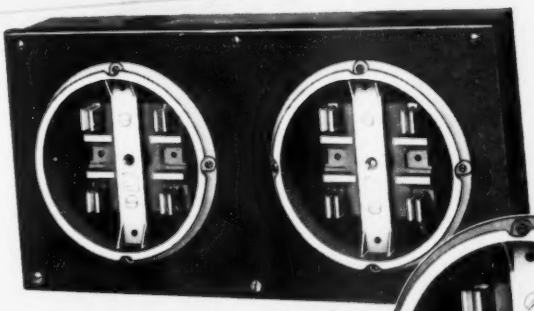
NEW SQUARE D

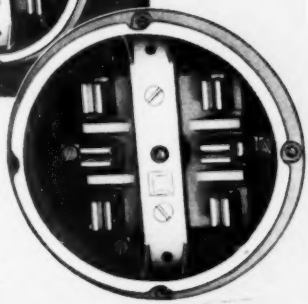
SOCKET METER TROUGHS

DESIGN LEADERSHIP

EASY TO WIRE INDOOR OR OUTDOOR TYPES







ABOVE • **2 Socket Meter Trough** — indoor type showing vertical position of jaws.

LEFT • **Outdoor type single socket trough** with socket. Front cover and die-cast ring only can be removed, leaving socket base accessible for easy wiring.

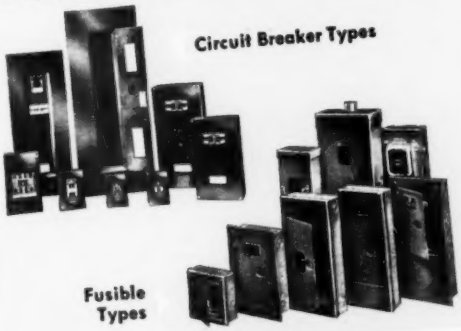
RIGHT • **Meter socket** showing one-piece porcelain base with six jaws. Base mounted on bracket with soft spring. Permits easy alignment of clips with cover.

Square D's new socket meter troughs are designed to mount the Type S meter which is currently in general use.

Rated 100 amperes, the sockets accommodate up to six jaws easily converted to either horizontal or vertical positions—have one-piece porcelain base designed for easy wiring, high dielectric and durability.

Meter troughs accommodate 1 to 4 meter sockets for meter "ganging"—provide generous wiring space and ample knockouts—available as indoor or outdoor types with flush or surface mounting covers. Outdoor troughs are designed to include Square D's interchangeable hubs.

Completes the Line of Service Entrance Equipment



Circuit Breaker Types

Fusible Types

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

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PREPARE FOR TODAY'S CHANGING DEMANDS WITH THESE G-E WIRING FACTS!

1. WHERE DO YOU NORMALLY LOCATE GENERAL ELECTRIC REMOTE-CONTROL MASTER SELECTOR SWITCHES?

This new multi-purpose G-E master selector switch gives homeowners control of up to nine different lights or outlets from a single point. But do you know WHAT LOCATIONS ARE RECOMMENDED FOR MASTER CONTROL SWITCH INSTALLATIONS?

2. WHAT WIRE SHOULD YOU USE IN LOCATIONS EXPOSED TO GASOLINE?

Until now, this problem required the use of heavy, lead-sheathed cables. Today, General Electric's new lightweight, hydrocarbon-resistant wire helps you do the job efficiently and economically. WHAT SHOULD YOU SPECIFY?

3. WHAT IS THE BEST PROTECTION FOR MACHINE TOOL LEADS THAT ARE SUBJECT TO VIBRATION?

Rigid protection used for this purpose is often bulky and fails to provide the necessary "play." There is a simple solution. But, DO YOU KNOW WHAT'S BEST?

4. WHY DO AVA POWER CABLES PACK MORE CURRENT INTO EXISTING RACEWAYS?

More current per raceway is a big feature of G-E Deltabeston* AVA cables. Capable of operating at high temperatures because they are insulated with heat-beating asbestos and varnished cambric—they can be used at normal ambient temperatures to crowd more current into raceways. HOW DO THEY DO IT?

5. HOW DO YOU AVOID "ROCKING" WHEN YOU INSTALL A SWITCHBOX?

The new G-E Levelock switchbox solves the problem of rocking during installation—speeds rough wiring on any job. HOW?

Answers

1. The most popular locations for the master selector switch are in the master bedroom and at entrance doorways. But, customers can specify its installation in any convenient spot.
2. General Electric Geotrol Type TW wire is the full name of this new gasoline-and-oil resistant wire.
3. Use G-E flexible steel conduit to simplify vibration-proof installations in close quarters.
4. Deltabeston AVA cables can carry as much as 64% more current than ordinary cables with 60C rating, because two layers of asbestos insulation permit (1) higher operating temperatures and (2) more current per conductor.
5. The G-E Levelock switchbox has four leveling projections. It can't rock or tilt.

*Registered Trade Mark of General Electric Company

FOR FURTHER INFORMATION

on any General Electric wiring materials, see your G-E Construction Materials distributor, or write to Section K54-518, Construction Materials Department, General Electric Company, Bridgeport 2, Conn.

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